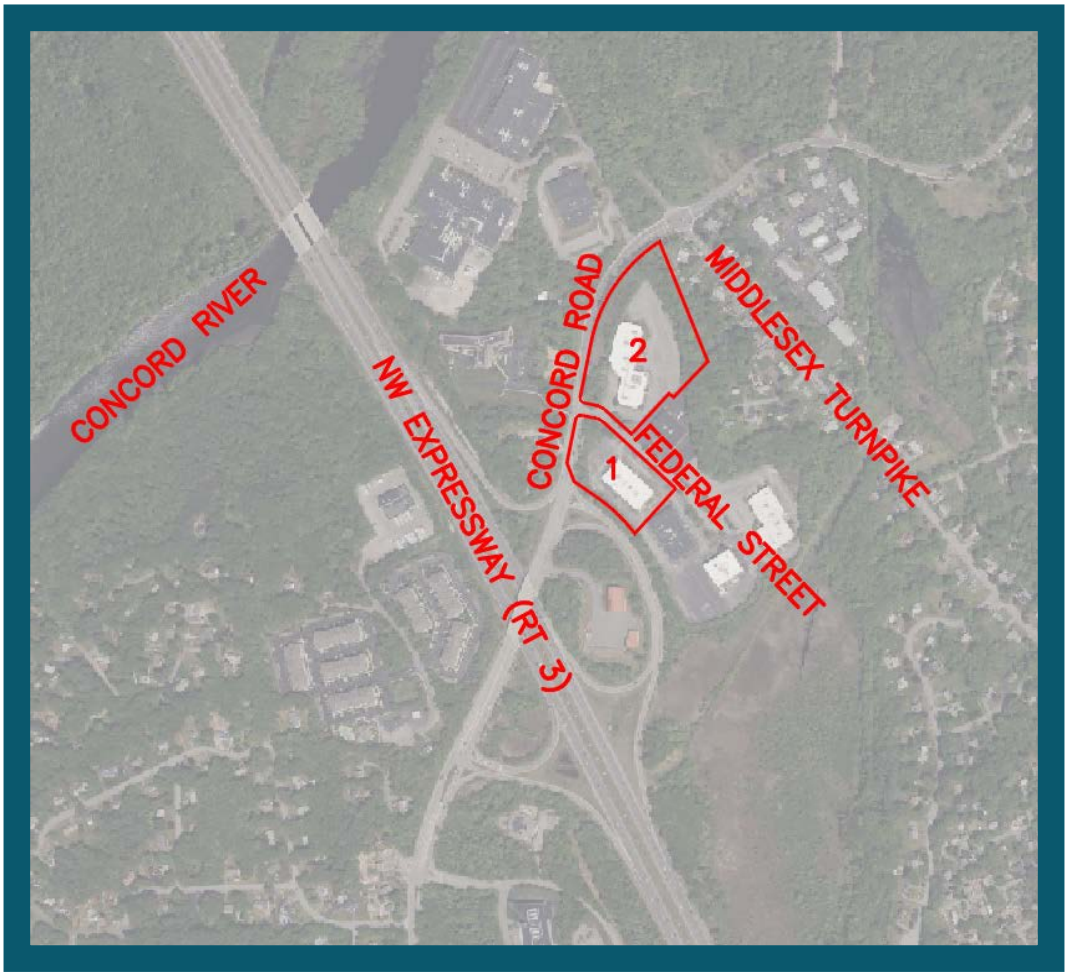
DRAINAGE REPORT

ALLEN & MAJOR
ASSOCIATES, INC.

JLB Billerica
Billerica, Massachusetts



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Billerica, Massachusetts

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ISSUED:

November 3, 2025

REVISED:

A&M PROJECT NO.:

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SECTION 1.0 -
DRAINAGE REPORT

Introduction

The purpose of this drainage report is to provide an overview of the proposed stormwater management system (SMS) for the JLB Billerica apartments project located at 1 and 2 Federal Street in Billerica, Massachusetts. The report will show by means of narrative, calculations and exhibits that the proposed stormwater management system will meet or exceed the Massachusetts Department of Environmental Protection (MassDEP) stormwater standards and the Billerica Stormwater Management Regulations.

The proposed site improvements include the construction of new apartment buildings with associated parking areas on two lots on opposite sides of Federal Street, where there are currently two office buildings with parking lots. The project meets the criteria for a redevelopment project per both the town and state stormwater regulations because there is an overall reduction in impervious area from existing conditions and improvements to the stormwater system are proposed. To further reduce impervious area, two areas at 2 Federal Street have been set aside for future parking if deemed necessary, but are proposed to remain in their natural state with minor landscaping adjacent to developed areas. Each of the two new apartment buildings will be serviced by town water and sewer, underground electric and natural gas.

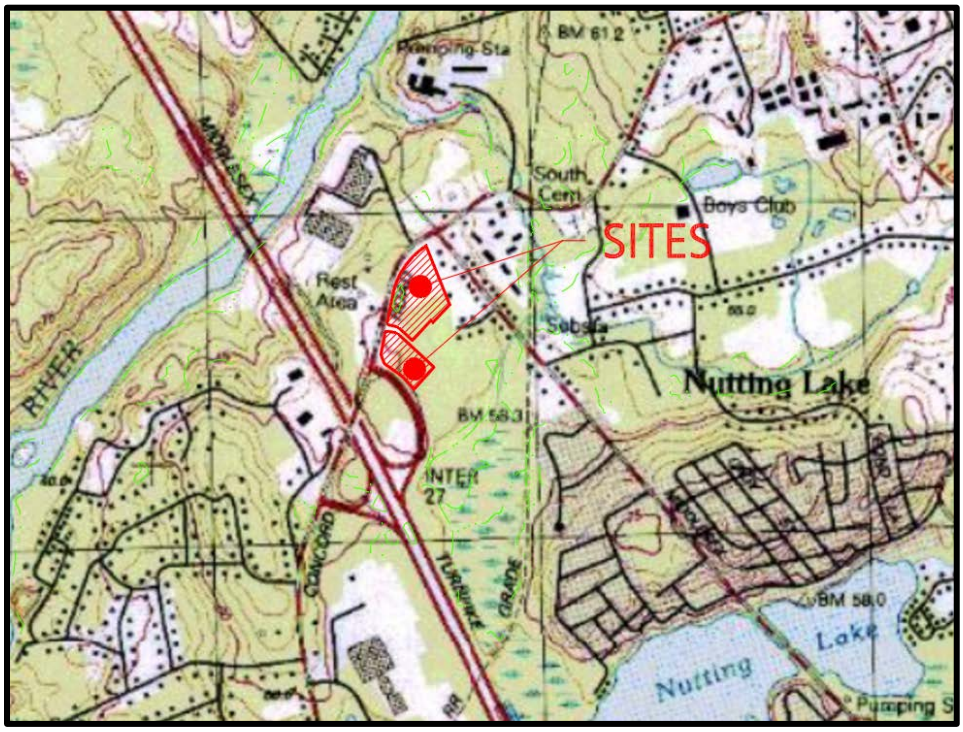
The proposed SMS incorporates structural and non-structural Best Management Practices (BMPs) to provide stormwater peak-flow mitigation, quality treatment, and conveyance. The SMS was carefully designed as a redevelopment project such that there is no net increase in impervious area compared to the current office use, and includes new deep-sump catch basins, proprietary oil/grit separation devices to remove pollutants and improve water quality, and several subsurface infiltration systems to meet recharge requirements.

Site Categorization for Stormwater Regulations

According to the Massachusetts Stormwater Handbook and the Billerica Stormwater Management Regulations, the proposed site improvements at 1 and 2 Federal Street are considered "redevelopment" due to the reduction in impervious area. A "redevelopment" project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions. The two reserve parking areas at 2 Federal Street are not planned to be constructed because sufficient parking is provided elsewhere but have been designed to meet new development requirements if necessary to be constructed in the future. See the discussion of Stormwater Management Standards that follows.

Site Location and Access

The project site consists of two lots with access driveways on opposite sides of Federal Street, where 1 Federal Street has 541 feet of total frontage on Federal Street and Concord Road, and 2 Federal Street has 1,196 total frontage on the same public ways. The parcels are located on the south side of Concord Road, between Middlesex Turnpike and the northbound, on/off ramp at Exit 76 on Route 3.



USGS Map (Source: MassMapper)

The parcels are abutted by other office buildings on Federal Street, residential homes along Middlesex Turnpike, and the Brightview Senior Living facility on the west side of Concord Road.

The two subject properties are accessed by existing curb cuts along Federal Street. The new construction will require new curb cuts at 1 Federal Street, and will make use of the existing curb cut locations at 2 Federal Street.

Existing Site Conditions

The existing, 2-story office building at 1 Federal Street has a building footprint area of approximately 29,679 s.f., parking for 165 cars, and a lot area of 3.24 acres. The existing, 2-story office building at 2 Federal Street has a building footprint area of approximately 49,897 s.f., 314 parking spaces, and a lot area of 7.85 acres. Each lot has 2 curb cuts on Federal Street, where one each is shared with the adjacent office buildings at 3 and 4 Federal Street. The site topography around each of the 2 office buildings and their

parking lots is relatively flat, with elevations ranging from approximately 191 to 194 feet (North American Vertical Datum of 1988, NAVD88) in the upland, developed area.

The parking area at 1 Federal is sloped such that stormwater runoff is split. Runoff from the west and south part of the site flows through drainage pipes across 3 Federal Street to an existing drainage system at the south end of Federal Street, and the north and east part of the site flows through drainage pipes that discharge to a drainage retention area located on 2 Federal Street that was constructed in the 1980's. All stormwater runoff from 2 Federal Street flows to this same drainage retention area, on the west side of the property adjacent to Concord Road. Much of the parking areas at 4 Federal Street and approximately 550 feet of Federal Street itself has catch basins that are piped into the drainage system at 2 Federal Street. The retention area has an outlet pipe connected to the drainage system in Concord Road.

Based on our review of "The Fields" "Site and Drainage Plan of Land in Billerica, Mass." by Joseph W. Moore Co. and Bruce M. Stamski, P.E. dated March 10, 1983, the retention area at 2 Federal Street was constructed to provide stormwater controls for the original industrial park when Federal Street was built in the 1980's. The Billerica Conservation Commission made a determination that this retention area now supports wetland vegetation and is considered bordering vegetated wetland because the outlet pipe is hydraulically connected to the downstream Concord River.

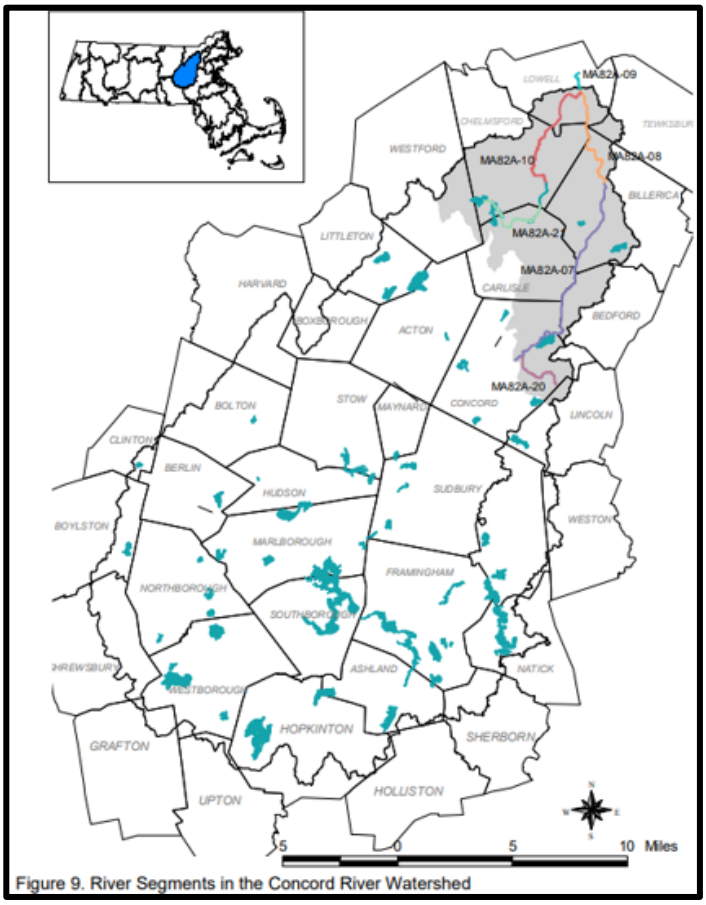
The surface drainage flows were analyzed at three Study Points. Study Point #1 summarizes off-site flows from 1 Federal Street generated from the parking and landscaped areas on the west and south sides of the building, and a portion of the roof area. This area flows to an existing catch basin at the southwest corner of the property that has a 15" RCP connected to other catch basins and the drainage system for the adjacent 3 and 5 Federal Street properties to the south. This stormwater flow discharges to a drainage swale at the south end of Federal Street per "The Fields" site and drainage plan referenced above.

Study Point #2 is the edge of the bordering vegetated wetland at 2 Federal Street. In addition to the stormwater discharges from 2 Federal Street, this study point receives runoff from the northeast portion of 1 Federal Street, from the majority of 4 Federal Street, and from the north end of Federal Street (approximately 550 ft.).

Study Point #3 is the easterly edge of 2 Federal Street adjacent to the residential properties on Middlesex Turnpike. This is a relatively flat, undeveloped, wooded area that drains to the northeast corner of the property. This area is proposed as a future bike path as part of the Yankee Doodle Bike Path per plans prepared for the Massachusetts Department of Transportation.

Watershed

The subject property is located within the Concord River watershed which is in the east-central portion of the state. The Concord River is formed by the confluence of the Assabet and Sudbury Rivers near the historic Egg Rock in the Town of Concord. The river flows north for approximately 15 miles through the towns of Concord, Carlisle, Bedford, and Billerica to the confluence with the Merrimack River in Lowell. See Exhibit 1 below.



Concord River Watershed

Source: SuAsCo Watershed Year 2001 Water Quality Assessment Report

Existing Soil Conditions

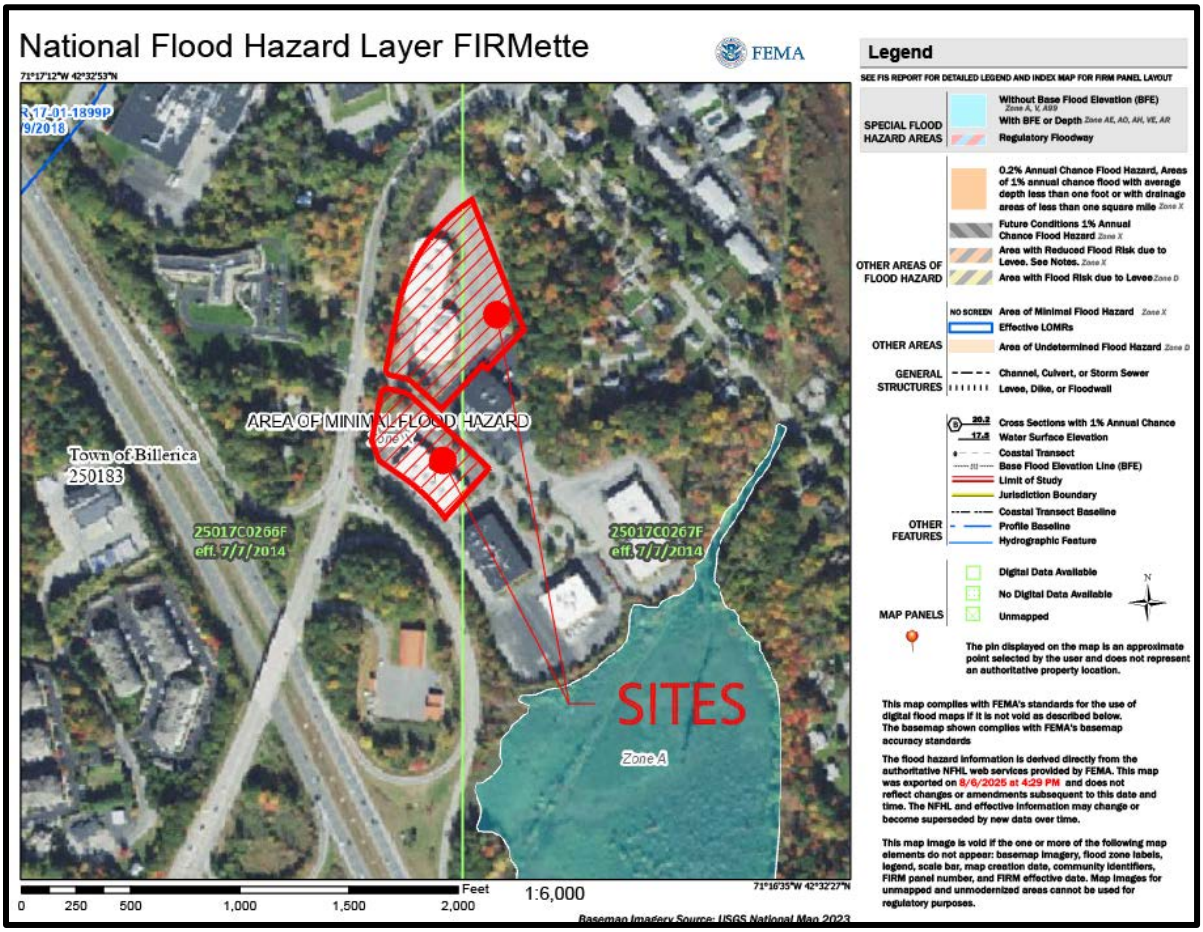
The on-site soils were identified using the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Middlesex County. The site soils are primarily characterized by gravel fill within paved areas, underlain by fine sandy loam (soil types Woodbridge and Urban Land); wooded areas to the north and east are classified as Scituate fine sandy loam. NRCS classifies all soils in the project area as being in Hydrologic Soil Group D, indicating low permeability soils. A copy of the NRCS Custom Soil Resource Report is included in the appendix of this report.

Further investigation of the underlying soils was conducted by performing nine (9) test borings designated GEO-1W through GEO-9W, of which seven were completed as groundwater monitoring wells by GeoEngineers USA. Refer to Appendix for the soil boring logs and location maps.

An exfiltration rate for the sandy loam soils has been determined to be 1.02 inches per hour based upon Table 2.3.3 1982 Rawls Rate from Volume 3: Documenting Compliance in the Massachusetts Stormwater Handbook.

FEMA Floodplain/Environmental Due Diligence

The property is not subject to flooding, located within an Area of Minimal Flood Hazard, Zone X per FEMA mapping. There are no portions of the site located within the FEMA Zone "AE" Special Flood Hazard Area Subject to Inundation by the 1% Annual Chance Flood (100-year floodplain). The official Flood Insurance Rate Map (FIRM), effective date July 7, 2014, Community Panel 25017C0266F, is shown below.



FEMA FIRM (Source: FEMA firmette, 25017C0266F, July 07, 2014)

Environmentally Sensitive Zones

The Commonwealth of Massachusetts asserts control over numerous protected and regulated areas including: Areas of Critical Environmental Concern (ACEC); Outstanding Resource Waters (ORWs); Priority and Protected Habitat for rare and endangered species, and areas protected under the Wetlands Protection Act. The subject property is not located within any of these regulated areas, except for the aforementioned bordering vegetated wetland associated with the existing retention area at 2 Federal Street.

Drainage Analysis Methodology

A peak rate of runoff will be determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.
2. HydroCAD © Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.20-7a. The HydroCAD program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/stage/storage characteristics for the stormwater BMPs, to perform drainage routing and to combine the results of the runoff hydrographs. HydroCAD uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).

Proposed Conditions – Peak Rate of Runoff

The stormwater runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Further, the analysis has been prepared in accordance with the MassDEP and Billerica stormwater management regulations and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10, 25 and 100-year storm events as required by the Billerica regulations.

The proposed stormwater management system for the site consists of deep sump catch basins, proprietary oil-grit separators, subsurface infiltration systems, and new energy-dissipation, riprap aprons at the drain pipe headwalls. These systems have been designed in accordance with the MA DEP Stormwater Management Policy to provide water quality, recharge groundwater, and reduce rate of runoff from the parcel.

The surface drainage flows were analyzed at three Study Points. Study Point #1 summarizes off-site flows from 1 Federal Street generated from the parking and landscaped areas on the west and south sides of the building, and a portion of the roof area. This area flows to an existing catch basin at the southwest corner of the property that has a 15" RCP connected to other catch basins and the drainage system for the

adjacent 3 and 5 Federal Street properties. This stormwater flow discharges to a drainage swale at the south end of Federal Street as shown on "The Fields" site and drainage plan referenced above.

Study Point #2 is the flow to the bordering vegetated wetland at 2 Federal Street. This study point receives runoff from the northeast portion of 1 Federal Street, all of the property at 2 Federal Street, a portion of 4 Federal Street, and approximately 550 ft. from the north end of Federal Street.

Study Point #3 is at the northeast corner of 2 Federal Street where runoff flows to an onsite low point. This is a relatively flat, undeveloped, wooded area.

The stormwater runoff model indicates that the proposed development reduces the rate of runoff during all storm events at the identified points of analysis. The following tables provide a summary of the estimated peak rate, in Cubic Feet per Second (CFS) and total runoff volume, in acre-feet (AF), at each of the three (3) Study Points for each of the design storm events. Refer to the HydroCAD worksheets included in Section 4 and 5.

	STUDY POINT #1 (Flow off-site toward 3 Federal St.)			
	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	4.97	8.10	10.53	15.45
Proposed Flow (CFS)	4.40	7.07	9.14	13.35
Decrease (CFS)	**0.57**	**1.03**	**1.39**	**2.10**
Existing Volume (AF)	0.400	0.669	0.882	1.325
Proposed Volume (AF)	0.397	0.655	0.859	1.282
Change (AF)	**-0.003**	**-0.014**	**-0.023**	**-0.043**
	STUDY POINT #2 (Flow to BVW at 2 Federal St.)			
	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	21.06	32.67	41.16	57.10
Proposed Flow (CFS)	17.30	28.97	39.63	44.50
Decrease (CFS)	**3.76**	**3.70**	**1.53**	**12.60**
Existing Volume (AF)	1.929	3.236	4.278	6.440
Proposed Volume (AF)	1.670	2.864	3.827	5.915
Change (AF)	**-0.259**	**-0.372**	**-0.451**	**-0.525**
	STUDY POINT #3 (Flow to NE corner of 2 Federal St.)			
	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.89	1.89	2.73	4.52
Proposed Flow (CFS)	0.91	1.85	2.63	4.28
Decrease (CFS)	**-0.02** *	**0.04**	**0.10**	**0.24**
Existing Volume (AF)	0.136	0.280	0.404	0.674
Proposed Volume (AF)	0.137	0.274	0.390	0.640
Change (AF)	**0.001**	**-0.006**	**-0.014**	**-0.034**

* Note: there is a de minimis increase in runoff to this study point for the 2-year storm only. However, there is no offsite runoff as there is a topographic depression at the northeast corner of the site where natural infiltration occurs.

MASSDEP Stormwater Performance Standards

The MassDEP Stormwater Management Regulations were developed to improve water quality by implementing performance standards for stormwater management. The intent is to implement these standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). In addition, Billerica Stormwater Management Regulations are administered by the Board of Health. The following section outlines how the proposed Stormwater Management System meets the standards set forth by the DEP and town regulations.

Stormwater Best Management Practices (BMP's) implemented in the design include:

- Deep Sump Catch Basins
- Proprietary Oil/Grit Separators
- Subsurface Infiltration Systems
- Low Impact Development (LID) BMP's include reduced impervious area from existing conditions (Redevelopment) and reduced parking from town requirements (Reserve Parking).
- Other stormwater system improvements include replacing existing headwalls at we, and placing

BMP's have been incorporated into the design of the project to mitigate the anticipated pollutant loading to the maximum extent practicable. An Operations and Maintenance Plan has been developed for the project, addressing the construction-period and long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls include tubular sediment barriers, as well as straw bale and/or other silt fence barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances as may be necessary. In addition, because the project will result in the disturbance of more than one acre of land, the proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) in accordance with MassDEP and US EPA National Pollutant Discharge Elimination System (NPDES) requirements for construction sites, prior to commencement of construction activities.

MassDEP has established ten Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. Billerica Stormwater Regulations require similar compliance on these same standards with some additional requirements. The Standards are enumerated

below as well as descriptions and supporting calculations as to how the Project will comply with the Standards:

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

   The proposed development will not introduce any new outfalls with direct discharge to a wetland area or waters of the Commonwealth of Massachusetts. There are three existing drainage outfalls with headwalls in close proximity to the edge of the bordering vegetated wetland on 2 Federal Street. Two of these are proposed to be removed with new headwalls relocated further back from the wetland to provide riprap aprons outside of the wetland area; the third headwall will be eliminated. This will allow easier future maintenance without disturbing the wetland. All onsite discharges will be treated to provide improved water quality tp the maximum extent practicable; runoff rates will be reduced from existing conditions and riprap aprons will be provided to prevent erosion. The stormwater discharge from 1 Federal Street to the south will also be treated and has a similar reduction in runoff rates from existing conditions.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

   The proposed development has been designed so that post-development peak discharge rates do not exceed the predevelopment peak discharge rates at the three Study Points for all design storms (2, 10, 25 and 100-year storms). Refer to the summary tables above showing reductions in proposed offsite discharge rates and volumes.

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

   See the appendix located at section 6 of this report for stormwater recharge calculations.

The proposed site improvements are classified as a "redevelopment" under the MA DEP Stormwater Management Standards based upon a reduction in impervious area from existing conditions. If required to be constructed, the reserve parking areas would be treated as new construction, requiring full compliance with this standard. Consequently, compliance with Standard #3 is required only to the maximum extent practicable as noted in Standard 7 below. This impervious area reduction has been achieved as follows.

- Existing impervious area on the 2 lots = 276,200 ± square feet
- Proposed impervious area = 274,042 ± square feet
- Change in impervious area = -2,158 ± square feet

Refer to the appendix located at section 6 of this report for stormwater recharge calculations showing approximately 7,147 cf of recharge provided using three proposed subsurface, infiltration chamber beds, exceeding the total required recharge volume of 3,082 cf. This standard has been met to the maximum extent practicable due to the limiting site constraints outlined in the narrative for Standard 7 Redevelopment below.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*
    - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
    - *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
    - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

    Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-term Pollution Prevention Plan; source control measures for pollution prevention are provided in the O&M plan. The required water quality volume for the site redevelopment impervious areas is captured and treated to the maximum extent practicable using deep sump catch basins, hydrodynamic separators and subsurface infiltration chambers. Based on the weighted average calculation for WQV in the appendix, this standard is met. Refer to Standard 7 Redevelopment for additional information.

The implemented BMPs have been designed to treat the contributing water quality volume to the maximum extent practicable because hydrodynamic separators have been provided prior to discharge at all pipe discharge points to the wetland and/or offsite, and it is not practical to construct additional infiltration systems due to the relatively impermeable soils (Hydrologic Soil Group D) and other site constraints (refer to Standard 7 narrative below for more information). Water quality calculations are provided in the appendix of this report.

The proposed stormwater management system has been designed to remove 80% of the average annual post-construction load at each of the three proposed subsurface infiltration beds, and a weighted average of 68% for the site. This requirement has been met to the maximum extent practicable as discussed above. The TSS removal calculations can be seen within the appendix of this report.

It should be noted that the TSS removal efficiency of 50% for the proprietary separator is based on the values assigned under the Technology Acceptance and Reciprocity Partnership (TARP) testing protocol. The TARP is a workgroup of the Environmental Council of States that was originally comprised of California, Illinois, Maryland, Massachusetts, New Jersey, New York, Pennsylvania and Virginia. TARP is recognized in the MA DEP Stormwater Management Handbook as a valid source for assigning TSS removal efficiencies for proprietary separators. However, the manufacturer claims higher removal efficiencies that were not used in our calculations.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

   The two sites at 1 and 2 Federal Street have a total of 255 apartments proposed, generating an estimate of 4.75 vehicle trips per day per apartment, or 1211 vehicle trips per day. Consequently, the combined project is considered a source of higher potential pollutant loads (LUHPPL) because the parking lots may generate more than 1,000 vehicle trips per day. Pretreatment and source reduction is provided to

the maximum extent practicable. The three proposed underground infiltration chambers have greater than 44% pretreatment and the overall drainage system is designed to treat 1" water quality volume to the maximum extent practicable (refer to Standards 3 and 7 for additional information. Pretreatment prior to the wetland discharges is also provided by using hydrodynamic separators at each outfall. The proprietary, oil/grit, hydrodynamic separators and underground infiltration systems are approved BMPs for use in a LUHPPL as listed in Table LUHPPL in the Massachusetts Stormwater Handbook, Volume 1: Overview of the Massachusetts Stormwater Standards, Chapter 1, Page 14. It should be noted that this requirement only applies to stormwater discharges that come into contact with the actual area or activity on the site that may generate the higher potential pollutant load; as such, roof areas, courtyard and amenity areas on the two sites are not required to meet this standard.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

   The project site does not discharge stormwater within a Zone II or Interim Wellhead Protection Area or near a critical area, and subsequently this standard is not applicable to this project. Critical Areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 314 CMR 9.02 and 310 CMR 10.04, and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4,*

5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The project is considered a redevelopment under the MA DEP Stormwater Management Standards as there is a decrease in the amount of total impervious area from existing conditions. As such, compliance with Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6 is required to the maximum extent practicable.

The properties at 1 and 2 Federal Street have several restrictive site design constraints including:

- All site soils are characterized in Hydrologic Soil Group D indicating less permeable soils that restrict the ability to provide infiltration systems.
- Due to existing shared driveways with adjacent properties at 3 and 4 Federal Street, site grading has to match existing grades near these locations. There are also existing catch basins, storm drain piping, and site drainage features on these adjoining parcels that must be incorporated into the development plans for 1 and 2 Federal Street, further limiting grading and restricting pipe elevations to maintain existing drainage patterns.
- Site topography is relatively flat necessitating placement of multiple catch basins that are connected to a relatively deep drainage trunk line that must discharge runoff from adjacent areas to the wetland. This makes it difficult if not impossible to provide conventional detention or retention basins that could be fitted with sediment forebays due to depth to groundwater which is estimated to be at elevation 185 ft. (i.e. the elevation of the drainage pipe inverts at the edge of the wetland).
- Approximately one acre of land was taken by the state for a future bike path, reducing available area for development and restricting the ability to provide additional stormwater systems.

Collectively, these restrictions limit full compliance with some of the stormwater standards. Standard 2 is met as noted above. The site design meets the recharge volume requirement for Standard 3, however, the three infiltration beds are not located such that they capture the required area flowing to them. Water quality volume requirements are fully achieved (see Standard 4 discussion), and pretreatment requirements of Standard 4 are met to the maximum extent practicable. We determined that providing additional infiltration systems would be difficult due to D low-permeability soils, required grades to match adjacent properties and due to setback requirements to the wetland for infiltration systems.

Standard 5 requiring 44% pretreatment and 1" water quality volume is similarly met to the maximum extent practicable for the same reasons. Standard 6 does not apply.

Accordingly, the project's stormwater design meets the redevelopment standard and other standards as noted to the maximum extent practicable.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction has been developed. A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings, and a construction-period operation and maintenance plan is a part of the Long-Term O&M plan provided in the appendix. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more. This standard is met.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   A Long-Term Operation & Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. This O&M plan includes construction period measures and pollution prevention measures also. See Section 2.0 of this report. This standard is met.

10. *All illicit discharges to the stormwater management system are prohibited.*

    There are no expected illicit discharges to the stormwater management system. The applicant will submit the Illicit Discharge Compliance Statement prior to the discharge of stormwater runoff to the post-construction stormwater best management practices and prior to the issuance of a Certificate of Compliance.

See attached MassDEP Stormwater Checklist.

Billerica Stormwater Management Requirements

Billerica Stormwater Management Regulations are administered by the Board of Health. The following section describes how the project stormwater system complies with additional criteria required by the town, beyond what is described above as requirements for MassDEP Stormwater Performance Standards.

Town regulations require specific treatment for pollutant causing impairment of down-gradient waterbodies identified by U.S. Environmental Protection Agency and MassDEP.

However, the onsite wetland where stormwater discharges has no Total Maximum Daily Load (TMDL) pollutant criteria associated with it.

Per Section 6.7.007 of the town Stormwater Regulations, performance standards for redevelopment sites require removal of 80% of the average annual post-construction load of TSS for onsite impervious areas and 50% of total phosphorus. As noted above in the narrative for DEP Standard 4, the project stormwater design achieves a weighted average of 68% TSS removal which is the maximum extent practicable, and a significant improvement over existing conditions. The appendix shows a calculation of approximately 20% phosphorus removal achieved using the three infiltration systems. As noted in the discussion for DEP Standard 7 above, the site has low permeability soils (all Hydrologic Soil Group D soils) and other site constraints that are not conducive to infiltration which is the optimum method to achieve phosphorus removal. Therefore, this standard is met to the maximum extent practicable.

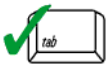
Other town standards have been met as described above in the DEP Performance Standards.

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

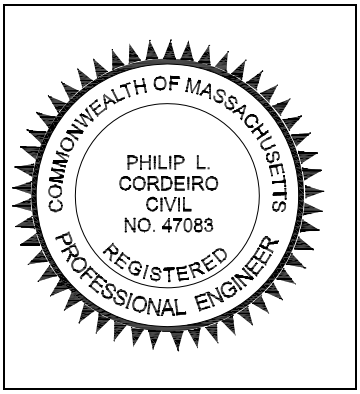
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



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Date: 2025.10.31 16:31:45-04'00'

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): Minimize impervious area; Subsurface Infiltration and Detention Sytstem

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

☒ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☒ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

SECTION 2.0 -
OPERATION & MAINTENANCE PLAN

OPERATION AND MAINTENANCE PLAN

INTRODUCTION

In accordance with the standards set forth by the Stormwater Management Policy issued by the Massachusetts Department of Environmental Protection (DEP) and Billerica's Stormwater Management Regulations, Allen & Major Associates, Inc. (A&M) has prepared the following Operation and Maintenance plan for the stormwater system at the JLB Billerica apartments complex at 1 and 2 Federal Street in Billerica.

This plan is broken into two major sections. The first section describes construction-related erosion and sedimentation controls which will require adherence to a Stormwater Pollution Prevention Plan (SWPPP) per USEPA National Pollutant Discharge Elimination System (NPDES) requirements for construction sites; the SWPPP will be prepared prior to commencing construction. The second section is devoted to a post-construction operation and maintenance plan and pollution prevention plan. A maintenance schedule is attached.

Stormwater Management System Owner: JLB Partners, LLC
2310 Washington Street
Newton, MA 02462

Emergency Contact Information:

- JLB Partners, LLC, c/o Mark Seck — Phone (508) 212-2787
- Allen & Major Associates, Inc. (Site Civil Engineer) — Phone (508) 923-1010
- Billerica Public Works — Phone (978) 671-0955
- Billerica Fire Department (business line) — Phone (978) 671-0941

The on-site stormwater management system (SMS) for this project will be owned by JLB Partners, LLC who shall be legally responsible for long-term operation and maintenance for this SMS as outlined in this Operation and Maintenance (O&M) Plan. It is noted that there are two existing catch basins at 4 Federal Street and two catch basins in the town-owned Federal Street that are piped into the 2 Federal Street drainage system discharging to the wetland. These combined stormwater runoff flows shall remain after construction. JLB Partners shall work with the owner of 4 Federal Street and provide reciprocal easements as may be required documenting ongoing maintenance and inspection requirements of these two catch basins; the town shall be responsible for ongoing maintenance of the catch basins and stormwater network in Federal Street. Should ownership of the SMS change, the succeeding owner will be presented with this O&M Plan and supporting attachments at or before legal conveyance of ownership and will assume the obligations of the O&M Plan.

In the event that the SMS will be operated and maintained by an entity other than that listed in this document, the applicant shall provide a plan and easement deed that provides a right of access for the legal entity to be able to perform said operation and maintenance functions. In the event the SMS will serve multiple lots/owners, the applicant shall also provide 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 entire SMS.

CONSRUCTION-PERIOD MAINTENANCE PLAN

The following tasks are a general guideline for the contractor and system owner to follow. Additional requirements for erosion controls and good housekeeping practices during construction shall be detailed in the SWPPP to be prepared prior to commencing construction.

1. Call Dig-Safe prior to commencing construction for utility markouts: 811 or 1-888-344-7233. Billerica DPW should also be contacted for locations of water and sewer lines.

2. Contact the Town of Billerica at least three (3) days prior to start of demolition and/or construction activities.

3. Install Erosion Control measures as shown on the Plans prepared by A&M. The Town of Billerica shall review the installation of straw bales and silt fencing prior to the start of any site demotion work. Install Construction fencing if determined to be necessary at the commencement of construction.

4. Install construction entrances & straw bales and silt fence at the locations shown on the Erosion Control Plan prepared by A&M.

5. Site access shall be achieved only from the designated construction entrances.

6. Cut and clear trees in construction areas only (within the limit of work; see plans).

7. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

8. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.

9. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on site for review.

10. All erosion control measures shall be maintained, repaired or replaced as required or at the direction of the owner's engineer or the Town of Billerica.

11. Sediment accumulation up-gradient of any erosion control barriers or straw bales,

silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.

12. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.

13. Install temporary sediment traps and stone check dams on site during construction as needed. Refer to the erosion control details. Temporary sediment traps combined with stone check dams shall be installed on site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.

14. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.

15. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.

16. Dust pollution shall be controlled using on-site water trucks and or an approved soil stabilization product.

17. During demolition and construction activities Status Reports on compliance with this O&M Document shall be submitted weekly. The report shall document any deficiencies and corrective actions taken by the applicant.

POST-CONSTRUCTION MAINTENANCE PLAN & POLLUTION PREVENTION PLAN

The SMS shall be inspected immediately after construction. A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

Inspection and Maintenance Frequency and Corrective Measures:

The following areas, facilities, and measures will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the footprint of the SMS.

The project site plans illustrate the location of the following SMS components that will require continuing inspections as outlined in this document:

- Deep Sump Catch Basins
- Proprietary Separators (7)
- Subsurface Infiltration Systems (3)
- Headwall Drainage Outfalls (2)
- Snow Storage (see Snow Storage Plan within project site plan set)

Monthly Post-Construction Inspection (First three months only)

Sub-surface Infiltration Systems:

Inspect the Infiltration system after all rainfalls greater than 1" to ensure that the system is draining within 72 hours. Repair as required.

Quarterly Inspections (specifically after foliage and snow season)

Deep Sump Catch Basins:

Inspect catch basins to ensure that they are working in their intended fashion, with grates free of debris to prevent puddling in parking areas. Structures will be skimmed of floatable debris at each inspection and sediment will be removed at a minimum once per year (typically after snow season) or when sediment has accumulated to within 2 feet of the outlet invert. The catch basin outlets are designed with a hood to trap floatable materials (i.e. Snout), and should be checked to ensure there is a watertight seal.

Proprietary Separators:
Separators shall be operated in strict accordance with manufacturer's recommended practices. Available manufacturer specific O&M plans attached as Appendix. Separators shall be inspected to ensure that they are working in their intended fashion and that they are free of debris. Structures shall be cleaned with a vacuum truck at least once annually (typically after snow season) or when sediment has accumulated to a depth of six inches (6"), whichever is more frequent.

Subsurface Infiltration Systems:
The subsurface structures will be inspected 24 hours or several days after large rain events (greater than 1.5"), to look for ponded water. Inspection can be accomplished by using the observation well, inspection port, and/or access structure for underground chamber systems.

Semi-Annual Inspection (specifically after foliage & snow season
Isolator rows:
Inspect Isolator row by using inspection port and/or access structure. Remove any accumulated sediment as needed when average depths reach 1" with a vacuum truck or per the manufacturer's recommendation.

Headwall Outfalls and Rip-Rap Aprons:
Inspect culverts discharging to the onsite wetland to ensure that the culverts are working in their intended fashion and that they are free of debris. Remove any obstructions to flow; remove accumulated sediments and debris at the outlet riprap apron, and within the conduit and to repair any erosion damage at the culvert's inlet and outlet. The rip-rap aprons will be inspected for erosion, debris accumulation, and unwanted vegetation. Erosion will be stabilized and sediment, debris, and woody vegetation will be removed. Rip rap should be repaired and/or replaced to maintain energy-dissipation capabilities.

Vegetated Areas: Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows.

Driveways and Parking Surfaces:
Sweep onsite paved areas as soon as possible after snow melt and no less than two times annually. Clear accumulations of winter sand in parking lots and driveways at least once a year, preferably in the spring. Accumulated sediment and sand on pavement may be removed by pavement sweeping or with other machinery (i.e., front-end loader) as required.

LANDSCAPE MANAGEMENT PLAN

It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff / landscape contractor must recognize the shortcomings of a general maintenance program such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis.

Additional care must be taken in landscaped areas with yard drains that convey stormwater to the discharge points. These areas include the courtyard and amenity areas that have catch basins draining to the SMS and are illustrated on the attached Operation and Maintenance Plan (OM-1).

Fertilizer

Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) should be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Only slow-release organic fertilizers should be used in the landscaped areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of developed areas on site will be performed within manufacturers labeling instructions. Additionally, the fertilizer will include a slow-release element and shall be Phosphorous free.

Suggested Aeration Program

In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin-tine aeration method to reduce disruption to the use of the area. The depth of solid-tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow-core or thin-tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

Landscape Maintenance Program Practices:

Lawn

- Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
- Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
- Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
- Do not remove grass clippings after mowing. (Except in Drainage BMP's)
- Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.
- Supplemental irrigation of lawn areas should provide 1" of water per week in two watering's per week—when no natural rainfall has occurred.

Shrubs

- Mulch not more than 3" depth with shredded pine or fir bark.
- Hand pruning shall be performed annually based on the natural growth characteristics of each species to keep plants from overgrowing walks and windows. NO SHEARING OF SHRUBS IS PERMITTED. Typically, pruning of each variety shall be immediately after blooming.
- Fertilize with ½ lb. slow-release fertilizer (see above section on Fertilizer) every second year.

- Hand prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

Trees

- Provide aftercare for new tree plantings for the first three years.
- Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
- Water once a week for the first year; twice a month the second, once a month the third year.
- Prune trees on a four-year cycle.

Management of Deicing Chemicals and Snow

Snow shall not be plowed towards the bordering vegetated wetland onsite or any other area protected by the Massachusetts Wetlands Protection Act. Additionally, it is prohibited to dump snow on top of catch basins within paved or landscaped areas. Snow shall only be stockpiled on site within the snow storage areas depicted on the Snow Management Plan, Sheets C-111 and C-112. If the stockpiles of snow do not fit within the designated areas, then snow will be disposed off-site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to the Massachusetts DEP, Bureau of Water Resources, Snow Disposal Guidance, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations. A copy of the MA DEP Snow Disposal Guidance, effective December 11, 2020, has been included at the end of Section 2 for reference.

The site's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The site may be required to use a de-icing agent such as potassium chloride (or approved equal) to maintain a safe walking surface; however, these are to be used at the minimum amount practicable. The de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the buildings. De-icing agents will not be stored outside.

Spill Prevention and Response

Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

1. Spill Hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.

2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
4. All spills shall be cleaned up immediately after discovery
5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

Pet Waste Management

Pet waste stations will be provided on site. Ultimately, it will be the responsibility of the pet owner to clean any waste and discard it in the provided stations.

OPERATION AND MAINTENANCE PLAN SCHEDULE **Date: 11-03-2025**

ALLEN & MAJOR ASSOCIATES, INC.

Project: Office Building/Office Parks
Project Address: 1 & 2 Federal Street Billerica MA

Responsible for O&M Plan: JLB Partners, LLC
Address: 2310 Washington Street Newton, MA 02462
Phone: (508) 212-2787

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
STRUCTURAL PRETREATMENT BMPs	DEEP SUMP CATCH BASIN	Four times per year (quarterly).	Inspect and clean catch basin units whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.	$1,000		
	PROPRIETARY SEPARATORS	In accordance with manufacturers requirements, but no less than twice a year following installation and once a year thereafter.	Remove sediment and other trapped pollutants at frequency or level specified by manufacturer.	$2,000		
INFILTRATION BMPs	SUBSURFACE STRUCTURES	Inspect structure inlets at least twice a year. Remove debris that may clog the system as needed.	Because subsurface structures are installed underground, they are extremely difficult to maintain. Remove any debris that might clog the system.	$500		
BMP ACCESSORIES	OUTLET STRUCTURES	Periodic cleaning of Outlet Control Structures as needed.	Clear trash and debris as necessary.	$500		
OTHER MAINTENANCE ACTIVITY	MISQUITO CONTROL	Inspect BMPs as needed to ensure the system's drainage time is less than the maximum 72 hour period.	Massachusetts stormwater handbook requires all stormwater practices that are designed to drain do so within 72 hours to reduce the number of mosquitos that mature to adults since the aquatic stage of a mosquito is 7-10 days.	$100		
	SNOW STORAGE	Clear and remove snow to approved storage locations as necessary to ensure systems are working properly and are protected from meltwater pollutants.	Carefully select snow disposal sites before winter. Avoid dumping removed snow over catch basins, or in detention ponds, sediment forebays, rivers, wetlands, and flood plains. It is also prohibited to dump snow in the bioretention basins or gravel swales.	$500		

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

Post-Construction Stormwater Treatment Practices

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Roads and Stormwater BMPs

In general, the stormwater BMPs used for land development projects can also be used for new roadways and roadway improvement projects. However, for improvement of existing roads, there are often constraints that limit the choice of BMP. These constraints derive from the linear configuration of the road, the limited area within the existing right-of-way, the structural and safety requirements attendant to good roadway design, and the long-term maintainability of the roadway drainage systems. The MassHighway Handbook provides strategies for dealing with the constraints associated with providing stormwater BMPs for roadway redevelopment projects.

Roadway design can minimize impacts caused by stormwater. Reducing roadway width reduces the total and peak volume of runoff. Designing a road with country drainage (no road shoulders or curbs) disconnects roadway runoff. Disconnection of roadway runoff is eligible for the Low Impact Site Design Credit provided the drainage is disconnected in accordance with specifications outlined in Volume 3.

Like other parties, municipalities that work within wetlands jurisdictional areas and adjacent buffer zones must design and implement structural stormwater best management practices in accordance with the Stormwater Management Standards and the Stormwater Management Handbook. In addition, in municipalities and areas where state agencies operate stormwater systems, the DPWs (or other town or state agencies) must meet the "good housekeeping" requirement of the municipality's or agency's MS4 permit.

MassHighway has taken stormwater management one step further by working with MassDEP to develop the MassHighway Storm Water Handbook for Highways and Bridges. The purpose of the MassHighway Handbook is to provide guidance for persons involved in the design, permitting, review and implementation of state highway projects, especially those involving existing roadways where physical constraints often limit the stormwater management options available. These constraints, like those common to redevelopment sites, may make it difficult to comply precisely with the requirements of the Stormwater Management Standards and the Massachusetts Stormwater Handbook.[3] In response to these constraints, MassDEP and MHD developed specific design, permitting, review and implementation practices that meet the unique challenges of providing environmental protection for existing state roads. The information in the MassHighway Handbook may also aid in the planning and design of projects to build new highways and to add lanes to existing highways, since they may face similar difficulties in meeting the requirements of the Stormwater Management Standards.

Although it is very useful, the MassHighway Handbook does not allow MassHighway projects to proceed without individual review and approval by the issuing authority when subject to the Wetlands Protection Act Regulations, 310 CMR 10.00, or the 401 Water Quality Certification Regulations, 314 CMR 9.00. For example, MassHighway must provide a Conservation Commission with a project-specific Operation and Maintenance Plan in accordance with Standard 9 that documents how the project's post-construction BMPs will be operated and maintained.[4]

[3] The 2004 MassHighway Handbook outlines standardized methods for dealing with these constraints as they apply to highway redevelopment projects. MassDEP and MassHighway intend to work together to provide guidance for add a lane projects when the 2004 Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards.

[4] The general permit for municipal separate storm sewer systems (the MS4 Permit) requires MassHighway to develop and implement procedures for the proper operation and maintenance of stormwater BMPs. To

Some municipalities have asked if the MassHighway Handbook governs municipal road projects. The answer is no.[5] The MassHighway Handbook was developed in response to the unique problems and challenges arising out of the management of the state highway system. Like other project proponents, cities and towns planning road or other projects in areas subject to jurisdiction under the Wetlands Protection Act must design and implement LID, non-structural and structural best management practices in accordance with the Stormwater Management Standards and the Massachusetts Stormwater Handbook.

avoid duplication of effort, MassHighway may be able rely on the same procedures to fulfill the operation and maintenance requirements of Standard 9 and the MS 4 Permit.

[5] Although the MassHighway Handbook does not govern municipal road projects, cities and towns may find some of the information presented in the Handbook useful.

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Massachusetts Department of Environmental Protection
Bureau of Water Resources
Snow Disposal Guidance

Effective Date: December 11, 2020

Applicability: Applies to all federal, state, regional and local agencies, as well as to private businesses.

Supersedes: Bureau of Resource Protection (BRP) Snow Disposal Guideline No. BRPG97-1 issued December 12, 1997 and BRPG01-01 issued March 8, 2001; Bureau of Water Resources (BWR) snow disposal guidance issued December 21, 2015 and December 12, 2018.

Approved by: Kathleen Baskin, Assistant Commissioner, Bureau of Water Resources

PURPOSE: To provide guidelines to all government agencies and private businesses regarding snow disposal site selection, site preparation and maintenance, and emergency snow disposal options that are protective of wetlands, drinking water, and water bodies, and are acceptable to the Massachusetts Department of Environmental Protection (MassDEP), Bureau of Water Resources.

APPLICABILITY: These Guidelines are issued by MassDEP's Bureau of Water Resources on behalf of all Bureau Programs (including Drinking Water Supply, Wetlands and Waterways, Wastewater Management, and Watershed Planning and Permitting). They apply to all federal agencies, state agencies, state authorities, municipal agencies and private businesses disposing of snow in the Commonwealth of Massachusetts.

INTRODUCTION

Finding a place to dispose of collected snow poses a challenge to municipalities and businesses as they clear roads, parking lots, bridges, and sidewalks. While MassDEP is aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into

waterbodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that communities can take to minimize the impacts of snow disposal on public health and the environment. These steps will help communities avoid the costs of a contaminated water supply, degraded waterbodies, and flooding. Everything that occurs on the land has the potential to impact the Commonwealth's water resources. Given the authority of local government over the use of the land, municipal officials and staff have a critically important role to play in protecting our water resources.

The purpose of these guidelines is to help federal agencies, state agencies, state authorities, municipalities and businesses select, prepare, and maintain appropriate snow disposal sites before the snow begins to accumulate through the winter. Following these guidelines and obtaining the necessary approvals may also help municipalities in cases when seeking reimbursement for snow disposal costs from the Federal Emergency Management Agency is possible.

RECOMMENDED GUIDELINES

These snow disposal guidelines address: (1) site selection; (2) site preparation and maintenance; and (3) emergency snow disposal.

1. SITE SELECTION

The key to selecting effective snow disposal sites is to locate them adjacent to or on pervious surfaces in upland areas or upland locations on impervious surfaces away from water resources and drinking water wells. At these locations, the snow meltwater can filter into the soil, leaving behind sand and debris which can be removed in the spring. The following conditions should be followed:

- Within water supply Zone A and Zone II, avoid storage or disposal of snow and ice containing deicing chemicals that has been collected from streets located outside these zones. Municipalities may have a water supply protection land use control that prohibits the disposal of snow and ice containing deicing chemicals from outside the Zone A and Zone II, subject to the Massachusetts Drinking Water Regulations at 310 CMR 22.20C and 310 CMR 22.21(2).
- Avoid storage or disposal of snow or ice in Interim Wellhead Protection Areas (IWPA) of public water supply wells, and within 75 feet of a private well, where road salt may contaminate water supplies.
- Avoid dumping snow into any waterbody, including rivers, the ocean, reservoirs, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid dumping snow on MassDEP-designated high and medium-yield aquifers where it may contaminate groundwater.
- Avoid dumping snow in sanitary landfills and gravel pits. Snow meltwater will create more contaminated leachate in landfills posing a greater risk to groundwater, and in gravel pits, there is little opportunity for pollutants to be filtered out of the meltwater because groundwater is close to the land surface.

- Avoid disposing of snow on top of storm drain catch basins or in stormwater drainage systems including detention basins, swales or ditches. Snow combined with sand and debris may block a stormwater drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.

Recommended Site Selection Procedures

It is important that the municipal Department of Public Works or Highway Department, Conservation Commission, and Board of Health work together to select appropriate snow disposal sites. The following steps should be taken:

- Estimate how much snow disposal capacity may be needed for the season so that an adequate number of disposal sites can be selected and prepared.
- Identify sites that could potentially be used for snow disposal, such as municipal open space (e.g., parking lots or parks).
- Select sites located in upland locations that are not likely to impact sensitive environmental resources first.
- If more storage space is still needed, prioritize the sites with the least environmental impact (using the site selection criteria, and local or MassGIS maps as a guide).

Snow Disposal Mapping Assistance

MassDEP has an online mapping tool to assist in identifying possible locations to potentially dispose of snow. MassDEP encourages municipalities to use this tool to identify possible snow disposal options. The tool identifies wetland resource areas, public drinking water supplies and other sensitive locations where snow should not be disposed. The tool may be accessed through the Internet at the following web address: **https://maps.env.state.ma.us/dep/arcgis/js/templates/PSF/**.

2. SITE PREPARATION AND MAINTENANCE

In addition to carefully selecting disposal sites before the winter begins, it is important to prepare and maintain these sites to maximize their effectiveness. The following maintenance measures should be undertaken for all snow disposal sites:

- A silt fence or equivalent barrier should be placed securely on the downgradient side of the snow disposal site.
- Wherever possible maintain a 50-foot vegetated buffer between the disposal site and adjacent waterbodies to filter pollutants from the meltwater.
- Clear debris from the site prior to using the site for snow disposal.
- Clear debris from the site and properly dispose of it at the end of the snow season, and no later than May 15.

3. SNOW DISPOSAL APPROVALS

Proper snow disposal may be undertaken through one of the following approval procedures:

- Routine snow disposal – Minimal, if any, administrative review is required in these cases when upland and pervious snow disposal locations or upland locations on impervious surfaces that have functioning and maintained stormwater management systems have been identified, mapped, and used for snow disposal following ordinary snowfalls. Use of upland and pervious snow disposal sites avoids wetland resource areas and allows snow meltwater to recharge groundwater and will help filter pollutants, sand, and other debris. This process will address the majority of snow removal efforts until an entity exhausts all available upland snow disposal sites. The location and mapping of snow disposal sites will help facilitate each entity's routine snow management efforts.
- Emergency Certifications – If an entity demonstrates that there is no remaining capacity at upland snow disposal locations, local conservation commissions may issue an Emergency Certification under the Massachusetts Wetlands Protection regulations to authorize snow disposal in buffer zones to wetlands, certain open water areas, and certain wetland resource areas (i.e. within flood plains). Emergency Certifications can only be issued at the request of a public agency or by order of a public agency for the protection of the health or safety of citizens, and are limited to those activities necessary to abate the emergency. See 310 CMR 10.06(1)-(4). Use the following guidelines in these emergency situations:
    - Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
    - Do not dispose of snow in salt marshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, Zone IIs or IWPAs of public water supply wells, Outstanding Resource Waters, or Areas of Critical Environmental Concern.
    - Do not dispose of snow where trucks may cause shoreline damage or erosion.
    - Consult with the municipal Conservation Commission to ensure that snow disposal in open water complies with local ordinances and bylaws.

- Severe Weather Emergency Declarations – In the event of a large-scale severe weather event, MassDEP may issue a broader Emergency Declaration under the Wetlands Protection Act which allows federal agencies, state agencies, state authorities, municipalities, and businesses greater flexibility in snow disposal practices. Emergency Declarations typically authorize greater snow disposal options while protecting especially sensitive resources such as public drinking water supplies, vernal pools, land containing shellfish, FEMA designated floodways, coastal dunes, and salt marsh. In the event of severe winter storm emergencies, the snow disposal site maps created by municipalities will enable MassDEP and the Massachusetts Emergency Management Agency (MEMA) in helping communities identify appropriate snow disposal locations.

  If upland disposal sites have been exhausted, the Emergency Declaration issued by MassDEP allows for snow disposal near water bodies. In these situations, a buffer of at

least 50 feet, preferably vegetated, should still be maintained between the site and the waterbody. Furthermore, it is essential that the other guidelines for preparing and maintaining snow disposal sites be followed to minimize the threat to adjacent waterbodies.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, the Emergency Declaration issued by MassDEP may allow disposal of snow in certain waterbodies under certain conditions. ***A federal agency, state agency, state authority, municipality or business seeking to dispose of snow in a waterbody should take the following steps***:

- Call the emergency contact phone number [(888) 304-1133)] and notify the MEMA of the municipality's intent.
- MEMA will ask for some information about where the requested disposal will take place.
- MEMA will confirm that the disposal is consistent with MassDEP's Severe Weather Emergency Declaration and these guidelines and is therefore approved.

During declared statewide snow emergency events, MassDEP's website will also highlight the emergency contact phone number [(888) 304-1133)] for authorizations and inquiries. For further non-emergency information about this Guidance you may contact your MassDEP Regional Office Service Center:

Northeast Regional Office, Wilmington, 978-694-3246
Southeast Regional Office, Lakeville, 508-946-2714
Central Regional Office, Worcester, 508-792-7650
Western Regional Office, Springfield, 413-755-2114

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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

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

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	yd3	m3
CDS2015-4	4	1.2	3.0	0.9	0.5	0.4
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

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

CONTECH Construction Products Inc. provides site solutions for the civil engineering industry. CONTECH's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other CONTECH division offerings, visit contech-cpi.com or call 800.338.1122

CONTECH® CONSTRUCTION PRODUCTS INC.
800.925.5240
contechstormwater.com

CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than eighteen inches the system should be cleaned out. **Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

Inspection & Maintenance Guide for

Corrugated Steel Pipe Underground Infiltration Systems

Safety: Before entering into any storm sewer or underground detention/infiltration system check to make sure all OSHA and local safety regulations and guidelines are observed during the maintenance process. Hard hats, safety glasses, steel-toed boots and any other appropriate personal protective equipment shall be worn at all times.

Frequency: Inspections shall be completed annually.

Inspection Check List:

√ Check quality of parking lot surface.

- Is there evidence of potholes or sinkholes?
- Is there evidence of an unusual amount of silt and soil build-up on the surface?

√ Check for pipe symmetry (uniform curvature).

- Flexible steel pipe is designed to handle minor deflections. Pipe structures deflected more than 7% from design shape, or those that show localized distortions may require further investigation.

√ Check for pipe joint quality.

- Is there evidence of backfill material infiltrating into the pipe structure?

√ Silt Deposition

- If accumulated silt is interfering with the operation of the infiltration system (i.e.: blocking infiltration holes or if silt deposition has significantly reduced the storage capacity of the system) it should be removed. This can be accomplished by the use of a “clam shell” device or vactor truck.

Maintenance:

Underground storm water detention and retention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size or configuration of the system.

Inspection

Inspection is the key to effective maintenance and is easily performed. CONTECH recommends ongoing quarterly inspections of the accumulated sediment. Sediment deposition and transport may vary from year to year and quarterly inspections will help insure that systems are cleaned out at the appropriate time. Inspections should be performed more often in the winter months in climates where sanding operations may lead to rapid accumulations, or in equipment wash-down areas. It is very useful to keep a record of each inspection. A sample inspection log is included for your use.

Systems should be cleaned when inspection reveals that accumulated sediment or trash is clogging the discharge orifice. CONTECH suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Cleaning

Maintaining an underground detention or retention system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities.

Inspection & Maintenance Log:

__" Diameter System			Location: Anywhere, USA		
Date	**Depth of Sediment**	**Accumulated Trash**	**Maintenance Performed**	**Maintenance Personnel**	Comments
12/01/99	2"	None	Removed Sediment	B. Johnson	Installed
03/01/00	1"	Some	Removed Sediment and Trash	B. Johnson	Swept parking lot
06/01/00	0"	None	None		
09/01/00	0"	Heavy	Removed Trash	S. Riley	
12/01/00	1"	None	Removed Sediment	S. Riley	
4/01/01	0"	None	None	S. Riley	
04/15/01	2"	Some	Removed Sediment and Trash	ACE Environmental Services	

CONTECH®
ENGINEERED SOLUTIONS

Stormceptor® STC
Owner's Manual

Stormceptor® STC

Table of Contents

For patent information, go to www.ContechES.com/ip.

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a "Hydrodynamic Separator (HDS)" or an "Oil Grit Separator (OGS)", engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- "STORMCEPTOR" is clearly marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site's tailwater conditions)
- Series Unit (combines treatment in two systems)

PLEASE MAINTAIN YOUR STORMCEPTOR

To ensure long-term environmental protection through continued performance as originally designed for your site, Stormceptor must be maintained, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call Contech at 1-800-338-1122.

2 – Stormceptor Operation and Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology. Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

Figure 1.

Inline Stormceptor

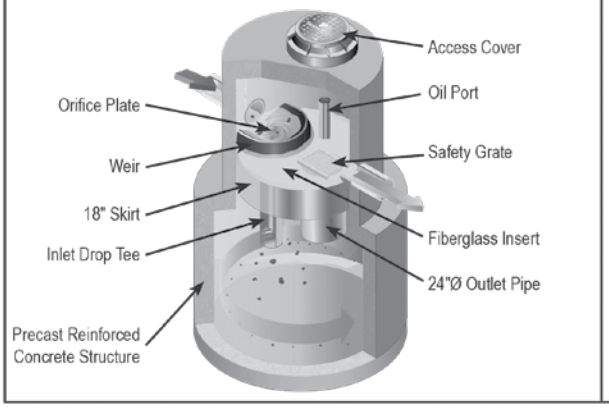
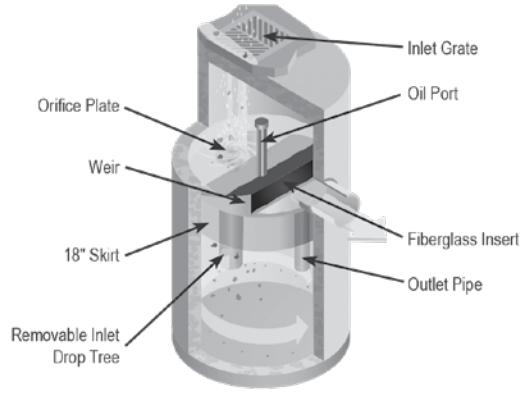


Figure 2.

Inlet Stormceptor



3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS and MAX) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using Table 1.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Contech Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS and OSR Stormceptor models are provided in Tables 1 and 2. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1. Stormceptor Dimensions - Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

Notes:

1. Depth Below Pipe Inlet Invert to the Inside Top Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2. Storage Capacities

STC Model	Hydrocarbon Storage Capacity (gal)	Sediment Capacity (ft^3)
450	86	46
900	251	89
1200	251	127
1800	251	207
2400	840	205
3600	840	373
4800	909	543
6000	909	687
7200	1059	839
11000*	2797	1089
13000*	2797	1374
16000*	3055	1677

Notes:

1. Hydrocarbon and Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series*

4 – Stormceptor Inspection and Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see Table 3). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.
- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in Table 2, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins.

For typical inspection and maintenance activities, no specific supplemental training is required

Recommended Stormceptor Inspection Procedure:

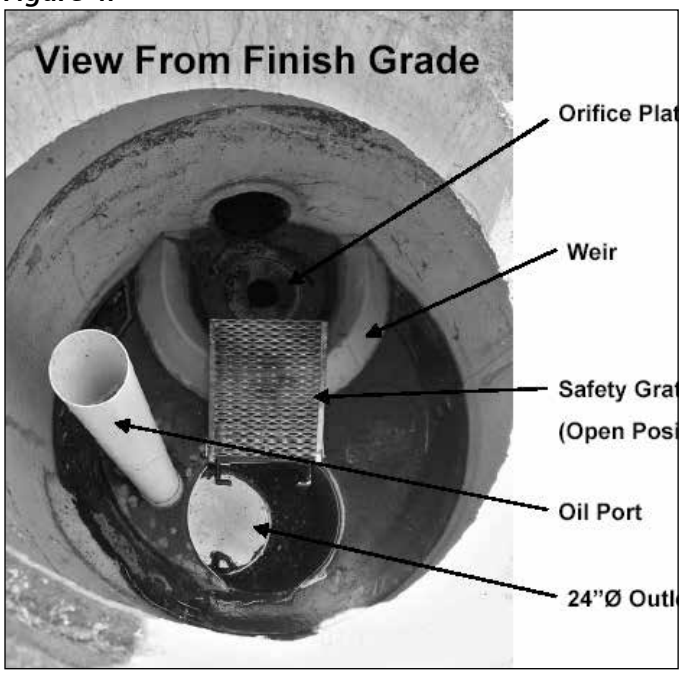
- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch or 6-inch diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, hoist and safety harness for specially trained personnel if confined space entry is required

Figure 3.

Figure 4.



Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck. No entry into the unit is required for maintenance. DO NOT ENTER THE STORMCEPTOR CHAMBER unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
  - » For 6-ft diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch outlet riser pipe (See Fig. 5).
  - » For 4-ft diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch drop tee hole (See Fig. 6).

Figure 5.

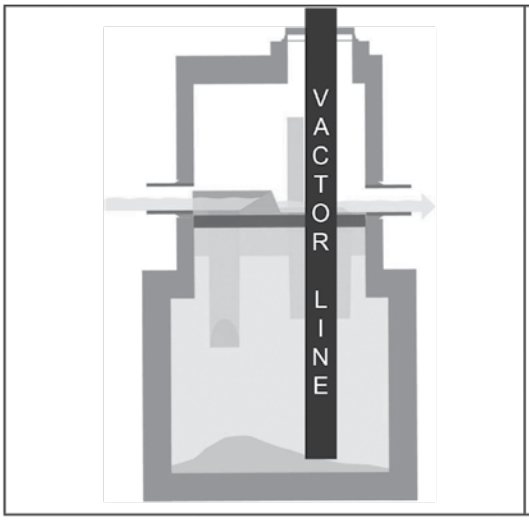
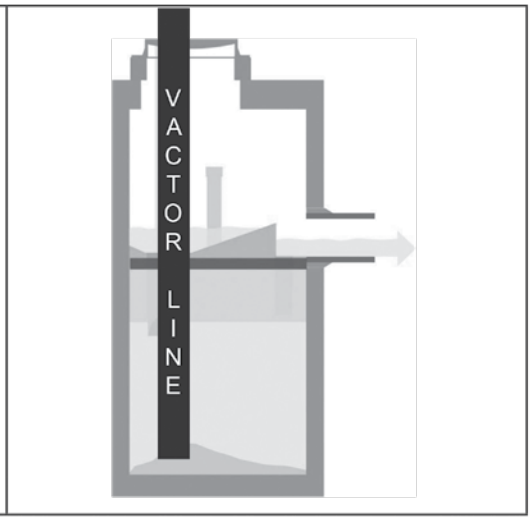


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in Table 3 based on the unit size.

Table 3. Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment Depth (in)
450	8
900	8
1200	10
1800	15
2400	12
3600	17
4800	15
6000	18
7200	15
11000*	17
13000*	20
16000*	17

Notes:

1. The values above are for typical standard units.

** Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Contech Representative or call 800-338-1122.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

5 – Contact Information

Questions regarding the Stormceptor can be addressed by contacting your local Contech representative or by calling 800-338-1122.

SUPPORT

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

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

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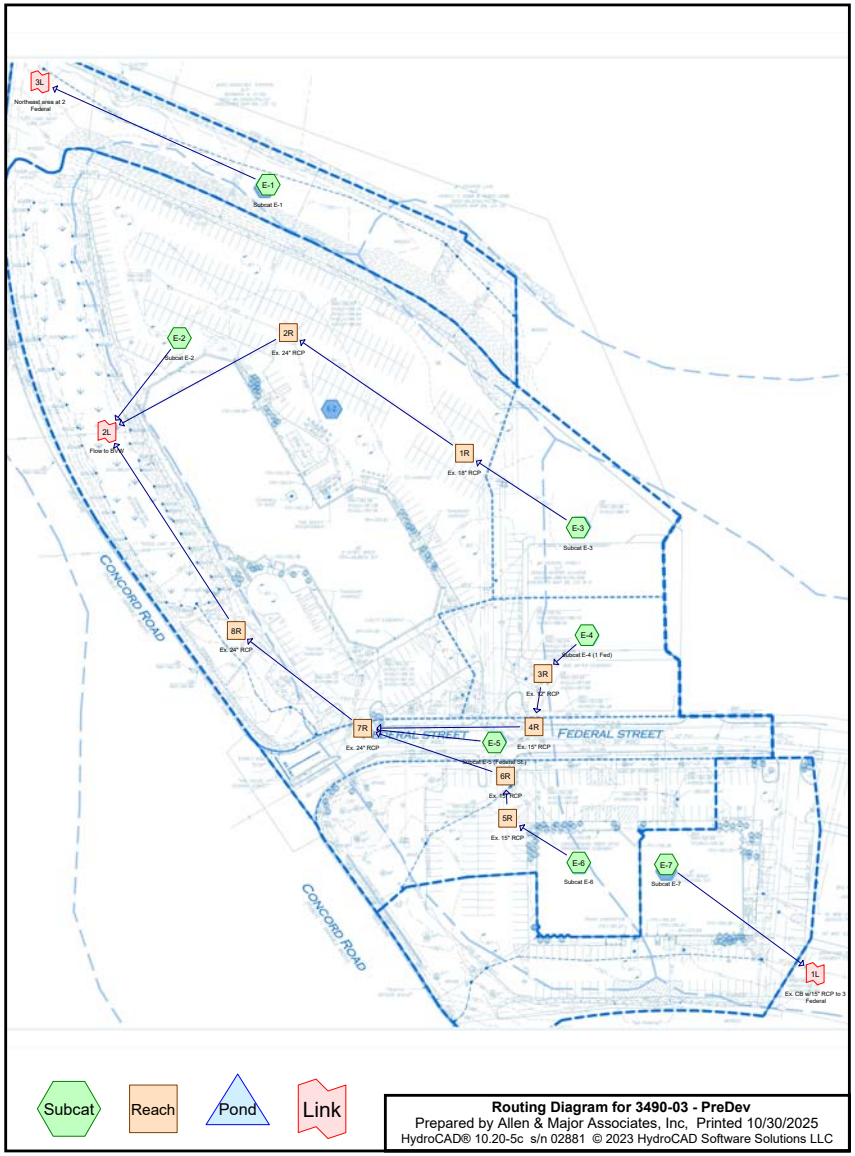
SECTION 3.0 -
EXISTING DRAINAGE ANALYSIS



Routing Diagram for 3490-03 - PreDev
Prepared by Allen & Major Associates, Inc, Printed 10/30/2025
HydroCAD® 10.20-5c s/n 02881 © 2023 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.130	80	>75% Grass cover, Good, HSG D (E-2, E-3, E-4, E-5, E-6, E-7)
5.940	98	Paved parking, HSG D (E-2, E-3, E-4, E-5, E-6, E-7)
2.284	98	Roofs, HSG D (E-2, E-3, E-4, E-6, E-7)
3.272	77	Woods, Good, HSG D (E-1, E-2, E-3, E-5, E-7)

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.89 cfs @ 12.61 hrs, Volume= 0.136 af, Depth= 1.18"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
60,239	77	Woods, Good, HSG D
60,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 11.85 cfs @ 12.20 hrs, Volume= 1.116 af, Depth= 2.13"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
32,868	80	>75% Grass cover, Good, HSG D
113,967	98	Paved parking, HSG D
49,897	98	Roofs, HSG D
76,941	77	Woods, Good, HSG D
273,673	90	Weighted Average
109,809		40.12% Pervious Area
163,864		59.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
4.1	200	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.6	250	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 2.48 cfs @ 12.09 hrs, Volume= 0.193 af, Depth= 2.71"
Routed to Reach 1R : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
1,021	80	>75% Grass cover, Good, HSG D
23,779	98	Paved parking, HSG D
9,932	98	Roofs, HSG D
2,563	77	Woods, Good, HSG D
37,295	96	Weighted Average
3,584		9.61% Pervious Area
33,711		90.39% Impervious Area

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

Summary for Subcatchment E-4: Subcat E-4 (1 Fed)

Runoff = 2.24 cfs @ 12.09 hrs, Volume= 0.172 af, Depth= 2.61"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
5,372	80	>75% Grass cover, Good, HSG D
19,233	98	Paved parking, HSG D
9,998	98	Roofs, HSG D
34,603	95	Weighted Average
5,372		15.52% Pervious Area
29,231		84.48% Impervious Area

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

Summary for Subcatchment E-5: Subcat E-5 (Federal St.)

Runoff = 1.98 cfs @ 12.09 hrs, Volume= 0.152 af, Depth= 2.61"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
4,909	80	>75% Grass cover, Good, HSG D
25,630	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
30,541	95	Weighted Average
4,911		16.08% Pervious Area
25,630		83.92% Impervious Area

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

Summary for Subcatchment E-6: Subcat E-6

Runoff = 3.87 cfs @ 12.10 hrs, Volume= 0.295 af, Depth= 2.31"
Routed to Reach 5R : Ex. 15" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
23,052	80	>75% Grass cover, Good, HSG D
28,948	98	Paved parking, HSG D
14,713	98	Roofs, HSG D
66,713	92	Weighted Average
23,052		34.55% Pervious Area
43,661		65.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.6	60	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	102	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
7.0	212	Total			

Summary for Subcatchment E-7: Subcat E-7

Runoff = 4.97 cfs @ 12.12 hrs, Volume= 0.400 af, Depth= 2.31"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
25,546	80	>75% Grass cover, Good, HSG D
47,189	98	Paved parking, HSG D
14,966	98	Roofs, HSG D
2,767	77	Woods, Good, HSG D
90,468	92	Weighted Average
28,313		31.30% Pervious Area
62,155		68.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
3.0	370	0.0100	2.03		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
8.6	420	Total			

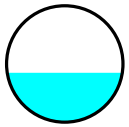
Summary for Reach 1R: Ex. 18" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 2.48 cfs @ 12.09 hrs, Volume= 0.193 af
Outflow = 2.31 cfs @ 12.15 hrs, Volume= 0.193 af, Atten= 7%, Lag= 3.7 min
Routed to Reach 2R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.35 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 6.3 min

Peak Storage= 291 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.63' , Surface Width= 1.48'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.40 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 410.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 186.64'



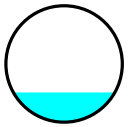
Summary for Reach 2R: Ex. 24" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 2.31 cfs @ 12.15 hrs, Volume= 0.193 af
Outflow = 2.22 cfs @ 12.18 hrs, Volume= 0.193 af, Atten= 4%, Lag= 1.7 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.63 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 3.0 min

Peak Storage= 134 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.51' , Surface Width= 1.74'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.15 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 212.0' Slope= 0.0051 '/'
Inlet Invert= 186.54', Outlet Invert= 185.46'



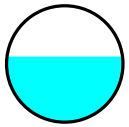
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 2.61" for 2-Year event
Inflow = 2.24 cfs @ 12.09 hrs, Volume= 0.172 af
Outflow = 2.23 cfs @ 12.09 hrs, Volume= 0.172 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.93 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 0.6 min

Peak Storage= 29 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.56' , Surface Width= 0.99'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



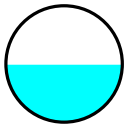
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 2.61" for 2-Year event
Inflow = 2.23 cfs @ 12.09 hrs, Volume= 0.172 af
Outflow = 2.21 cfs @ 12.10 hrs, Volume= 0.172 af, Atten= 1%, Lag= 0.3 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.70 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.24 fps, Avg. Travel Time= 0.6 min

Peak Storage= 27 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.62' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



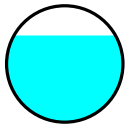
Summary for Reach 5R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 2.31" for 2-Year event
Inflow = 3.87 cfs @ 12.10 hrs, Volume= 0.295 af
Outflow = 3.84 cfs @ 12.11 hrs, Volume= 0.295 af, Atten= 1%, Lag= 0.3 min
Routed to Reach 6R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.95 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 0.5 min

Peak Storage= 40 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.93' , Surface Width= 1.09'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.28 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 41.0' Slope= 0.0044 '/'
Inlet Invert= 188.26', Outlet Invert= 188.08'



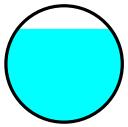
Summary for Reach 6R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 2.31" for 2-Year event
Inflow = 3.84 cfs @ 12.11 hrs, Volume= 0.295 af
Outflow = 3.78 cfs @ 12.11 hrs, Volume= 0.295 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.63 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 0.7 min

Peak Storage= 55 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.00' , Surface Width= 1.00'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 3.90 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 52.0' Slope= 0.0037 '/'
Inlet Invert= 187.68', Outlet Invert= 187.49'



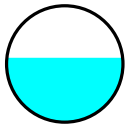
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 2.46" for 2-Year event
Inflow = 7.93 cfs @ 12.10 hrs, Volume= 0.620 af
Outflow = 7.70 cfs @ 12.12 hrs, Volume= 0.620 af, Atten= 3%, Lag= 1.0 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.43 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.47 fps, Avg. Travel Time= 1.7 min

Peak Storage= 274 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.10' , Surface Width= 1.99'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



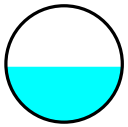
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 2.46" for 2-Year event
Inflow = 7.70 cfs @ 12.12 hrs, Volume= 0.620 af
Outflow = 7.49 cfs @ 12.14 hrs, Volume= 0.620 af, Atten= 3%, Lag= 1.4 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.16 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 2.1 min

Peak Storage= 318 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.95' , Surface Width= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 2.077 ac, 68.70% Impervious, Inflow Depth = 2.31" for 2-Year event
Inflow = 4.97 cfs @ 12.12 hrs, Volume= 0.400 af
Primary = 4.97 cfs @ 12.12 hrs, Volume= 0.400 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

Inflow Area = 10.166 ac, 66.87% Impervious, Inflow Depth = 2.28" for 2-Year event
Inflow = 21.06 cfs @ 12.17 hrs, Volume= 1.929 af
Primary = 21.06 cfs @ 12.17 hrs, Volume= 1.929 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

Inflow Area = 1.383 ac, 0.00% Impervious, Inflow Depth = 1.18" for 2-Year event
Inflow = 0.89 cfs @ 12.61 hrs, Volume= 0.136 af
Primary = 0.89 cfs @ 12.61 hrs, Volume= 0.136 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E-1: Subcat E-1

Runoff = 1.89 cfs @ 12.59 hrs, Volume= 0.280 af, Depth= 2.43"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
60,239	77	Woods, Good, HSG D
60,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 19.91 cfs @ 12.20 hrs, Volume= 1.914 af, Depth= 3.65"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
32,868	80	>75% Grass cover, Good, HSG D
113,967	98	Paved parking, HSG D
49,897	98	Roofs, HSG D
76,941	77	Woods, Good, HSG D
273,673	90	Weighted Average
109,809		40.12% Pervious Area
163,864		59.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
4.1	200	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.6	250	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 3.83 cfs @ 12.09 hrs, Volume= 0.307 af, Depth= 4.30"
Routed to Reach 1R : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
1,021	80	>75% Grass cover, Good, HSG D
23,779	98	Paved parking, HSG D
9,932	98	Roofs, HSG D
2,563	77	Woods, Good, HSG D
37,295	96	Weighted Average
3,584		9.61% Pervious Area
33,711		90.39% Impervious Area

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

Summary for Subcatchment E-4: Subcat E-4 (1 Fed)

Runoff = 3.51 cfs @ 12.09 hrs, Volume= 0.277 af, Depth= 4.19"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
5,372	80	>75% Grass cover, Good, HSG D
19,233	98	Paved parking, HSG D
9,998	98	Roofs, HSG D
34,603	95	Weighted Average
5,372		15.52% Pervious Area
29,231		84.48% Impervious Area

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

Summary for Subcatchment E-5: Subcat E-5 (Federal St.)

Runoff = 3.10 cfs @ 12.09 hrs, Volume= 0.245 af, Depth= 4.19"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
4,909	80	>75% Grass cover, Good, HSG D
25,630	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
30,541	95	Weighted Average
4,911		16.08% Pervious Area
25,630		83.92% Impervious Area

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

Summary for Subcatchment E-6: Subcat E-6

Runoff = 6.30 cfs @ 12.10 hrs, Volume= 0.493 af, Depth= 3.86"
Routed to Reach 5R : Ex. 15" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
23,052	80	>75% Grass cover, Good, HSG D
28,948	98	Paved parking, HSG D
14,713	98	Roofs, HSG D
66,713	92	Weighted Average
23,052		34.55% Pervious Area
43,661		65.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.6	60	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	102	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
7.0	212	Total			

Summary for Subcatchment E-7: Subcat E-7

Runoff = 8.10 cfs @ 12.12 hrs, Volume= 0.669 af, Depth= 3.86"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
25,546	80	>75% Grass cover, Good, HSG D
47,189	98	Paved parking, HSG D
14,966	98	Roofs, HSG D
2,767	77	Woods, Good, HSG D
90,468	92	Weighted Average
28,313		31.30% Pervious Area
62,155		68.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
3.0	370	0.0100	2.03		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
8.6	420	Total			

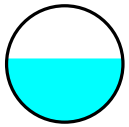
Summary for Reach 1R: Ex. 18" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 4.30" for 10-Year event
Inflow = 3.83 cfs @ 12.09 hrs, Volume= 0.307 af
Outflow = 3.58 cfs @ 12.14 hrs, Volume= 0.307 af, Atten= 7%, Lag= 3.4 min
Routed to Reach 2R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.75 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 5.6 min

Peak Storage= 405 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.82' , Surface Width= 1.49'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.40 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 410.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 186.64'



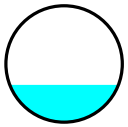
Summary for Reach 2R: Ex. 24" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 4.30" for 10-Year event
Inflow = 3.58 cfs @ 12.14 hrs, Volume= 0.307 af
Outflow = 3.47 cfs @ 12.17 hrs, Volume= 0.307 af, Atten= 3%, Lag= 1.4 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.12 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 2.7 min

Peak Storage= 183 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.64' , Surface Width= 1.86'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.15 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 212.0' Slope= 0.0051 '/'
Inlet Invert= 186.54', Outlet Invert= 185.46'



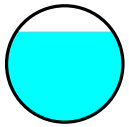
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 4.19" for 10-Year event
Inflow = 3.51 cfs @ 12.09 hrs, Volume= 0.277 af
Outflow = 3.49 cfs @ 12.09 hrs, Volume= 0.277 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.36 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.91 fps, Avg. Travel Time= 0.6 min

Peak Storage= 42 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.78' , Surface Width= 0.83'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



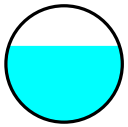
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 4.19" for 10-Year event
Inflow = 3.49 cfs @ 12.09 hrs, Volume= 0.277 af
Outflow = 3.47 cfs @ 12.10 hrs, Volume= 0.277 af, Atten= 1%, Lag= 0.3 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.10 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.42 fps, Avg. Travel Time= 0.5 min

Peak Storage= 37 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.82' , Surface Width= 1.19'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



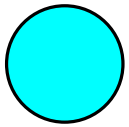
Summary for Reach 5R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 3.86" for 10-Year event
Inflow = 6.30 cfs @ 12.10 hrs, Volume= 0.493 af
Outflow = 4.28 cfs @ 12.10 hrs, Volume= 0.493 af, Atten= 32%, Lag= 0.0 min
Routed to Reach 6R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.97 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 0.4 min

Peak Storage= 50 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.28 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 41.0' Slope= 0.0044 '/'
Inlet Invert= 188.26', Outlet Invert= 188.08'



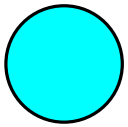
Summary for Reach 6R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 3.86" for 10-Year event
Inflow = 4.28 cfs @ 12.10 hrs, Volume= 0.493 af
Outflow = 3.90 cfs @ 12.10 hrs, Volume= 0.493 af, Atten= 9%, Lag= 0.0 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.50 fps, Avg. Travel Time= 0.6 min

Peak Storage= 64 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 3.90 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 52.0' Slope= 0.0037 '/'
Inlet Invert= 187.68', Outlet Invert= 187.49'



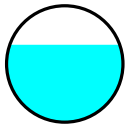
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 4.03" for 10-Year event
Inflow = 10.46 cfs @ 12.09 hrs, Volume= 1.016 af
Outflow = 10.30 cfs @ 12.11 hrs, Volume= 1.016 af, Atten= 2%, Lag= 0.9 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.72 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.69 fps, Avg. Travel Time= 1.5 min

Peak Storage= 341 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.33' , Surface Width= 1.89'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



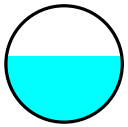
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 4.03" for 10-Year event
Inflow = 10.30 cfs @ 12.11 hrs, Volume= 1.016 af
Outflow = 10.05 cfs @ 12.13 hrs, Volume= 1.016 af, Atten= 2%, Lag= 1.2 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.56 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.96 fps, Avg. Travel Time= 1.8 min

Peak Storage= 398 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.14' , Surface Width= 1.98'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 2.077 ac, 68.70% Impervious, Inflow Depth = 3.86" for 10-Year event
Inflow = 8.10 cfs @ 12.12 hrs, Volume= 0.669 af
Primary = 8.10 cfs @ 12.12 hrs, Volume= 0.669 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

Inflow Area = 10.166 ac, 66.87% Impervious, Inflow Depth = 3.82" for 10-Year event
Inflow = 32.67 cfs @ 12.17 hrs, Volume= 3.236 af
Primary = 32.67 cfs @ 12.17 hrs, Volume= 3.236 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

Inflow Area = 1.383 ac, 0.00% Impervious, Inflow Depth = 2.43" for 10-Year event
Inflow = 1.89 cfs @ 12.59 hrs, Volume= 0.280 af
Primary = 1.89 cfs @ 12.59 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E-1: Subcat E-1

Runoff = 2.73 cfs @ 12.58 hrs, Volume= 0.404 af, Depth= 3.51"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
60,239	77	Woods, Good, HSG D
60,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 26.18 cfs @ 12.20 hrs, Volume= 2.552 af, Depth= 4.88"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
32,868	80	>75% Grass cover, Good, HSG D
113,967	98	Paved parking, HSG D
49,897	98	Roofs, HSG D
76,941	77	Woods, Good, HSG D
273,673	90	Weighted Average
109,809		40.12% Pervious Area
163,864		59.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
4.1	200	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.6	250	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 4.88 cfs @ 12.09 hrs, Volume= 0.396 af, Depth= 5.56"
Routed to Reach 1R : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
1,021	80	>75% Grass cover, Good, HSG D
23,779	98	Paved parking, HSG D
9,932	98	Roofs, HSG D
2,563	77	Woods, Good, HSG D
37,295	96	Weighted Average
3,584		9.61% Pervious Area
33,711		90.39% Impervious Area

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

Summary for Subcatchment E-4: Subcat E-4 (1 Fed)

Runoff = 4.49 cfs @ 12.09 hrs, Volume= 0.360 af, Depth= 5.44"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
5,372	80	>75% Grass cover, Good, HSG D
19,233	98	Paved parking, HSG D
9,998	98	Roofs, HSG D
34,603	95	Weighted Average
5,372		15.52% Pervious Area
29,231		84.48% Impervious Area

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

Summary for Subcatchment E-5: Subcat E-5 (Federal St.)

Runoff = 3.97 cfs @ 12.09 hrs, Volume= 0.318 af, Depth= 5.44"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
4,909	80	>75% Grass cover, Good, HSG D
25,630	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
30,541	95	Weighted Average
4,911		16.08% Pervious Area
25,630		83.92% Impervious Area

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

Summary for Subcatchment E-6: Subcat E-6

Runoff = 8.18 cfs @ 12.10 hrs, Volume= 0.651 af, Depth= 5.10"
Routed to Reach 5R : Ex. 15" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
23,052	80	>75% Grass cover, Good, HSG D
28,948	98	Paved parking, HSG D
14,713	98	Roofs, HSG D
66,713	92	Weighted Average
23,052		34.55% Pervious Area
43,661		65.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.6	60	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	102	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
7.0	212	Total			

Summary for Subcatchment E-7: Subcat E-7

Runoff = 10.53 cfs @ 12.12 hrs, Volume= 0.882 af, Depth= 5.10"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
25,546	80	>75% Grass cover, Good, HSG D
47,189	98	Paved parking, HSG D
14,966	98	Roofs, HSG D
2,767	77	Woods, Good, HSG D
90,468	92	Weighted Average
28,313		31.30% Pervious Area
62,155		68.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
3.0	370	0.0100	2.03		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
8.6	420	Total			

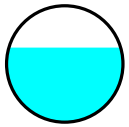
Summary for Reach 1R: Ex. 18" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 5.56" for 25-Year event
Inflow = 4.88 cfs @ 12.09 hrs, Volume= 0.396 af
Outflow = 4.56 cfs @ 12.14 hrs, Volume= 0.396 af, Atten= 7%, Lag= 3.2 min
Routed to Reach 2R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.96 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.32 fps, Avg. Travel Time= 5.2 min

Peak Storage= 490 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.96' , Surface Width= 1.44'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.40 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 410.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 186.64'



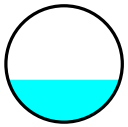
Summary for Reach 2R: Ex. 24" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 5.56" for 25-Year event
Inflow = 4.56 cfs @ 12.14 hrs, Volume= 0.396 af
Outflow = 4.43 cfs @ 12.16 hrs, Volume= 0.396 af, Atten= 3%, Lag= 1.3 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.42 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.43 fps, Avg. Travel Time= 2.5 min

Peak Storage= 218 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.73' , Surface Width= 1.92'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.15 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 212.0' Slope= 0.0051 '/'
Inlet Invert= 186.54', Outlet Invert= 185.46'



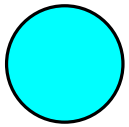
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 5.44" for 25-Year event
Inflow = 4.49 cfs @ 12.09 hrs, Volume= 0.360 af
Outflow = 3.70 cfs @ 12.10 hrs, Volume= 0.360 af, Atten= 18%, Lag= 0.8 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.37 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.05 fps, Avg. Travel Time= 0.5 min

Peak Storage= 50 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



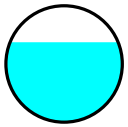
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 5.44" for 25-Year event
Inflow = 3.70 cfs @ 12.10 hrs, Volume= 0.360 af
Outflow = 3.71 cfs @ 12.10 hrs, Volume= 0.360 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.15 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 0.5 min

Peak Storage= 39 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.86' , Surface Width= 1.16'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



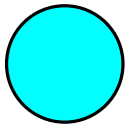
Summary for Reach 5R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 5.10" for 25-Year event
Inflow = 8.18 cfs @ 12.10 hrs, Volume= 0.651 af
Outflow = 4.28 cfs @ 12.05 hrs, Volume= 0.651 af, Atten= 48%, Lag= 0.0 min
Routed to Reach 6R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.92 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.73 fps, Avg. Travel Time= 0.4 min

Peak Storage= 50 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.28 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 41.0' Slope= 0.0044 '/'
Inlet Invert= 188.26', Outlet Invert= 188.08'



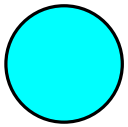
Summary for Reach 6R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 5.10" for 25-Year event
Inflow = 4.28 cfs @ 12.05 hrs, Volume= 0.651 af
Outflow = 4.15 cfs @ 12.01 hrs, Volume= 0.651 af, Atten= 3%, Lag= 0.0 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.62 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 0.5 min

Peak Storage= 64 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 3.90 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 52.0' Slope= 0.0037 '/'
Inlet Invert= 187.68', Outlet Invert= 187.49'



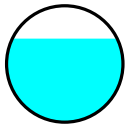
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 5.27" for 25-Year event
Inflow = 11.57 cfs @ 12.09 hrs, Volume= 1.329 af
Outflow = 11.47 cfs @ 12.11 hrs, Volume= 1.329 af, Atten= 1%, Lag= 1.0 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.80 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.82 fps, Avg. Travel Time= 1.4 min

Peak Storage= 371 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.43' , Surface Width= 1.80'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



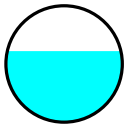
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 5.27" for 25-Year event
Inflow = 11.47 cfs @ 12.11 hrs, Volume= 1.329 af
Outflow = 11.28 cfs @ 12.13 hrs, Volume= 1.329 af, Atten= 2%, Lag= 1.1 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.71 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.11 fps, Avg. Travel Time= 1.7 min

Peak Storage= 433 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.22' , Surface Width= 1.95'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 2.077 ac, 68.70% Impervious, Inflow Depth = 5.10" for 25-Year event
Inflow = 10.53 cfs @ 12.12 hrs, Volume= 0.882 af
Primary = 10.53 cfs @ 12.12 hrs, Volume= 0.882 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

Inflow Area = 10.166 ac, 66.87% Impervious, Inflow Depth = 5.05" for 25-Year event
Inflow = 41.16 cfs @ 12.18 hrs, Volume= 4.278 af
Primary = 41.16 cfs @ 12.18 hrs, Volume= 4.278 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

Inflow Area = 1.383 ac, 0.00% Impervious, Inflow Depth = 3.51" for 25-Year event
Inflow = 2.73 cfs @ 12.58 hrs, Volume= 0.404 af
Primary = 2.73 cfs @ 12.58 hrs, Volume= 0.404 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Subcatchment E-1: Subcat E-1

Runoff = 4.52 cfs @ 12.57 hrs, Volume= 0.674 af, Depth= 5.85"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
60,239	77	Woods, Good, HSG D
60,239		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 38.92 cfs @ 12.19 hrs, Volume= 3.883 af, Depth= 7.42"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
32,868	80	>75% Grass cover, Good, HSG D
113,967	98	Paved parking, HSG D
49,897	98	Roofs, HSG D
76,941	77	Woods, Good, HSG D
273,673	90	Weighted Average
109,809		40.12% Pervious Area
163,864		59.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.21"
4.1	200	0.0270	0.82		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
14.6	250	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 7.03 cfs @ 12.09 hrs, Volume= 0.581 af, Depth= 8.14"
Routed to Reach 1R : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
1,021	80	>75% Grass cover, Good, HSG D
23,779	98	Paved parking, HSG D
9,932	98	Roofs, HSG D
2,563	77	Woods, Good, HSG D
37,295	96	Weighted Average
3,584		9.61% Pervious Area
33,711		90.39% Impervious Area

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

Summary for Subcatchment E-4: Subcat E-4 (1 Fed)

Runoff = 6.50 cfs @ 12.09 hrs, Volume= 0.531 af, Depth= 8.02"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
5,372	80	>75% Grass cover, Good, HSG D
19,233	98	Paved parking, HSG D
9,998	98	Roofs, HSG D
34,603	95	Weighted Average
5,372		15.52% Pervious Area
29,231		84.48% Impervious Area

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

Summary for Subcatchment E-5: Subcat E-5 (Federal St.)

Runoff = 5.74 cfs @ 12.09 hrs, Volume= 0.469 af, Depth= 8.02"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
4,909	80	>75% Grass cover, Good, HSG D
25,630	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
30,541	95	Weighted Average
4,911		16.08% Pervious Area
25,630		83.92% Impervious Area

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

Summary for Subcatchment E-6: Subcat E-6

Runoff = 12.00 cfs @ 12.10 hrs, Volume= 0.977 af, Depth= 7.66"
Routed to Reach 5R : Ex. 15" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
23,052	80	>75% Grass cover, Good, HSG D
28,948	98	Paved parking, HSG D
14,713	98	Roofs, HSG D
66,713	92	Weighted Average
23,052		34.55% Pervious Area
43,661		65.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.6	60	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	102	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
7.0	212	Total			

Summary for Subcatchment E-7: Subcat E-7

Runoff = 15.45 cfs @ 12.12 hrs, Volume= 1.325 af, Depth= 7.66"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
25,546	80	>75% Grass cover, Good, HSG D
47,189	98	Paved parking, HSG D
14,966	98	Roofs, HSG D
2,767	77	Woods, Good, HSG D
90,468	92	Weighted Average
28,313		31.30% Pervious Area
62,155		68.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
3.0	370	0.0100	2.03		**Shallow Concentrated Flow, BC** Paved Kv= 20.3 fps
8.6	420	Total			

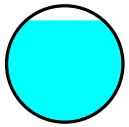
Summary for Reach 1R: Ex. 18" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 7.03 cfs @ 12.09 hrs, Volume= 0.581 af
Outflow = 6.53 cfs @ 12.14 hrs, Volume= 0.581 af, Atten= 7%, Lag= 3.2 min
Routed to Reach 2R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.13 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 4.6 min

Peak Storage= 672 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.31' , Surface Width= 1.00'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.40 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 410.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 186.64'



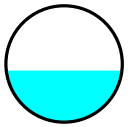
Summary for Reach 2R: Ex. 24" RCP

Inflow Area = 0.856 ac, 90.39% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 6.53 cfs @ 12.14 hrs, Volume= 0.581 af
Outflow = 6.38 cfs @ 12.16 hrs, Volume= 0.581 af, Atten= 2%, Lag= 1.2 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.86 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.60 fps, Avg. Travel Time= 2.2 min

Peak Storage= 284 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.88' , Surface Width= 1.99'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.15 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 212.0' Slope= 0.0051 '/'
Inlet Invert= 186.54', Outlet Invert= 185.46'



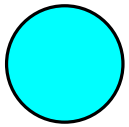
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 8.02" for 100-Year event
Inflow = 6.50 cfs @ 12.09 hrs, Volume= 0.531 af
Outflow = 3.83 cfs @ 12.45 hrs, Volume= 0.531 af, Atten= 41%, Lag= 21.8 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.35 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.29 fps, Avg. Travel Time= 0.5 min

Peak Storage= 50 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



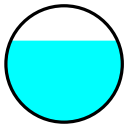
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.794 ac, 84.48% Impervious, Inflow Depth = 8.02" for 100-Year event
Inflow = 3.83 cfs @ 12.45 hrs, Volume= 0.531 af
Outflow = 3.81 cfs @ 12.45 hrs, Volume= 0.531 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.17 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 0.4 min

Peak Storage= 40 cf @ 12.45 hrs
Average Depth at Peak Storage= 0.87' , Surface Width= 1.15'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



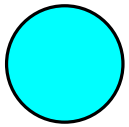
Summary for Reach 5R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 7.66" for 100-Year event
Inflow = 12.00 cfs @ 12.10 hrs, Volume= 0.977 af
Outflow = 4.77 cfs @ 12.98 hrs, Volume= 0.977 af, Atten= 60%, Lag= 52.8 min
Routed to Reach 6R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.97 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.93 fps, Avg. Travel Time= 0.4 min

Peak Storage= 50 cf @ 11.90 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.28 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 41.0' Slope= 0.0044 '/'
Inlet Invert= 188.26', Outlet Invert= 188.08'



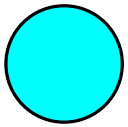
Summary for Reach 6R: Ex. 15" RCP

Inflow Area = 1.532 ac, 65.45% Impervious, Inflow Depth = 7.66" for 100-Year event
Inflow = 4.77 cfs @ 12.98 hrs, Volume= 0.977 af
Outflow = 4.06 cfs @ 11.87 hrs, Volume= 0.977 af, Atten= 15%, Lag= 0.0 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.80 fps, Avg. Travel Time= 0.5 min

Peak Storage= 64 cf @ 11.90 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 3.90 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 52.0' Slope= 0.0037 '/'
Inlet Invert= 187.68', Outlet Invert= 187.49'



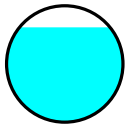
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 7.84" for 100-Year event
Inflow = 13.32 cfs @ 12.09 hrs, Volume= 1.977 af
Outflow = 13.20 cfs @ 12.10 hrs, Volume= 1.977 af, Atten= 1%, Lag= 1.0 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.86 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.06 fps, Avg. Travel Time= 1.2 min

Peak Storage= 422 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.63' , Surface Width= 1.56'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



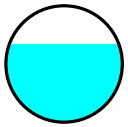
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.027 ac, 74.72% Impervious, Inflow Depth = 7.84" for 100-Year event
Inflow = 13.20 cfs @ 12.10 hrs, Volume= 1.977 af
Outflow = 13.03 cfs @ 12.12 hrs, Volume= 1.977 af, Atten= 1%, Lag= 1.1 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.87 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.39 fps, Avg. Travel Time= 1.5 min

Peak Storage= 484 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.34' , Surface Width= 1.88'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 2.077 ac, 68.70% Impervious, Inflow Depth = 7.66" for 100-Year event
Inflow = 15.45 cfs @ 12.12 hrs, Volume= 1.325 af
Primary = 15.45 cfs @ 12.12 hrs, Volume= 1.325 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

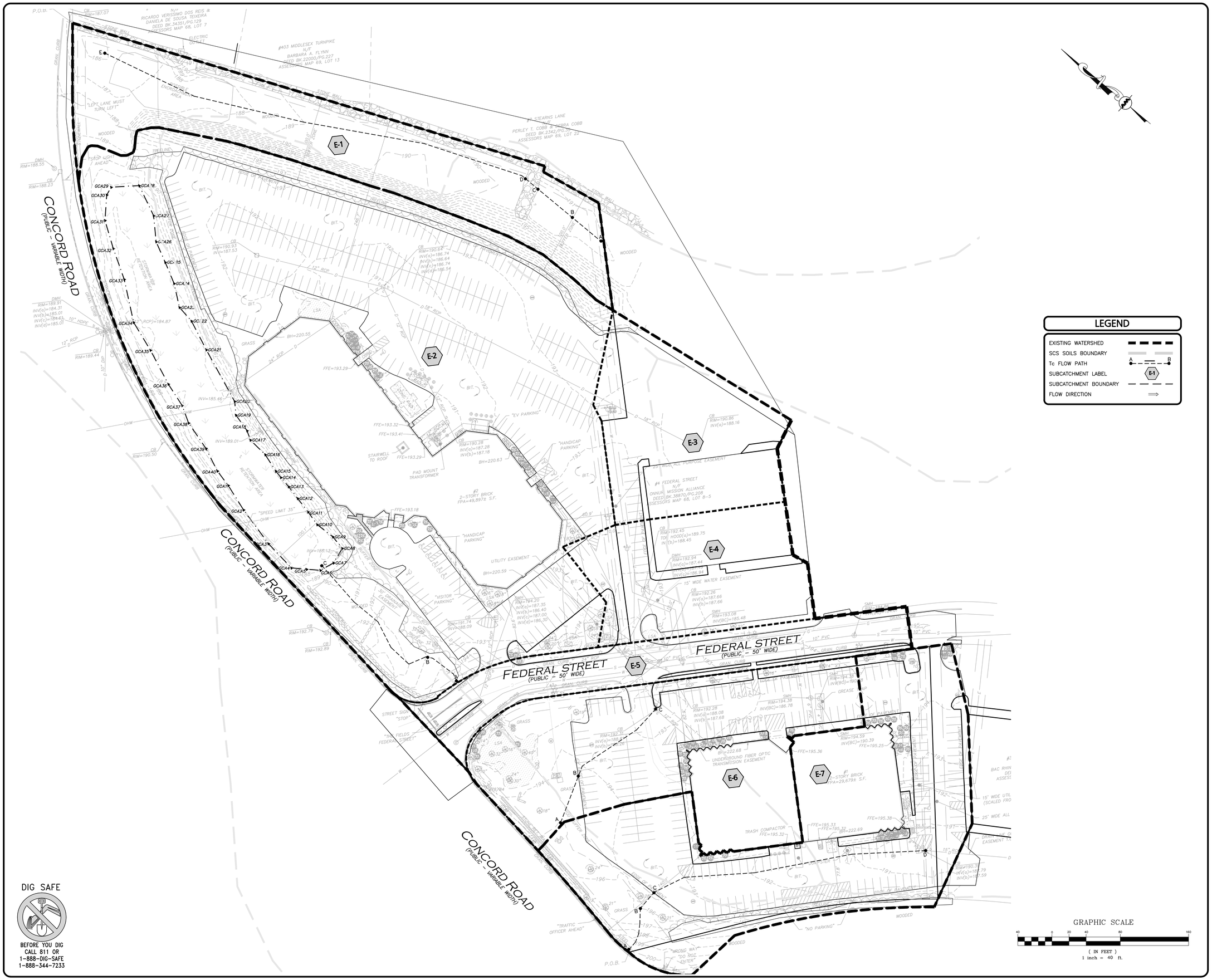
Inflow Area = 10.166 ac, 66.87% Impervious, Inflow Depth = 7.60" for 100-Year event
Inflow = 57.10 cfs @ 12.18 hrs, Volume= 6.440 af
Primary = 57.10 cfs @ 12.18 hrs, Volume= 6.440 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

Inflow Area = 1.383 ac, 0.00% Impervious, Inflow Depth = 5.85" for 100-Year event
Inflow = 4.52 cfs @ 12.57 hrs, Volume= 0.674 af
Primary = 4.52 cfs @ 12.57 hrs, Volume= 0.674 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs



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M:\PROJECTS\3490-03\CIVIL\DRAWINGS\CURRENT\C-3490-03_WATERSHED-EXISTING.DWG

ISSUED FOR
SITE PLAN REVIEW AND NOI
NOVEMBER 3, 2025

COMMONWEALTH OF MASSACHUSETTS
PHILIP L. CORDEIRO
CIVIL
NO. 47085
REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Philip Cordeiro
Date: 2025.10.31 16:31:54-04'00'

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION

APPLICANT\OWNER:
JLB REALTY, LLC
2310 WASHINGTON STREET
NEWTON, MA 02462

PROJECT:
JLB BILLERICA
1 & 2 FEDERAL STREET
BILLERICA, MA

PROJECT NO.	3490-03	DATE:	11-03-2025
SCALE:	1" = 40'	DWG. NAME:	C3490-03
DESIGNED BY:	SF/JAP	CHECKED BY:	PLC

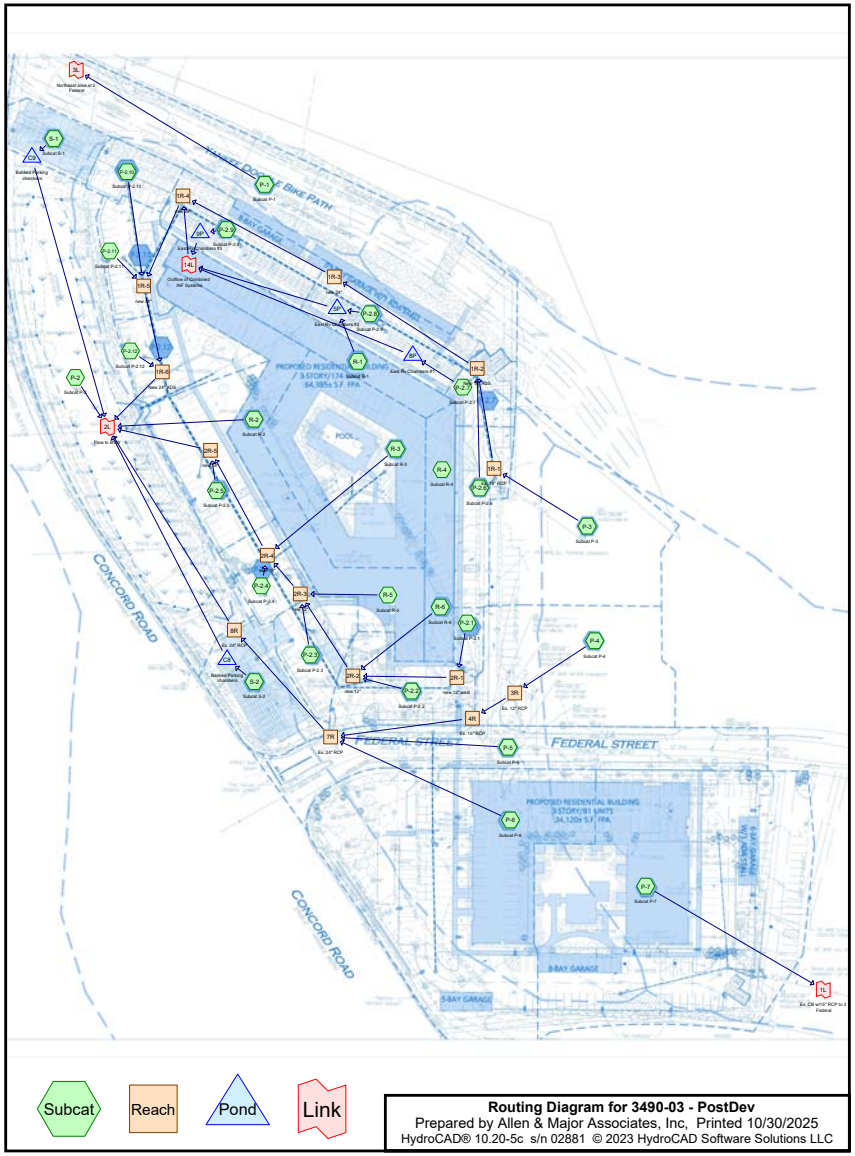
PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
10 MAIN STREET
LAKEVILLE, MA 02347
TEL: (508) 923-1010
FAX: (508) 923-6309
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
EXISTING WATERSHED PLAN

SHEET No.
EWS

SECTION 4.0 -
PROPOSED DRAINAGE ANALYSIS



Routing Diagram for 3490-03 - PostDev
Prepared by Allen & Major Associates, Inc, Printed 10/30/2025
HydroCAD® 10.20-5c s/n 02881 © 2023 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.612	80	>75% Grass cover, Good, HSG D (P-1, P-2, P-2.1, P-2.10, P-2.11, P-2.12, P-2.2, P-2.3, P-2.4, P-2.5, P-2.6, P-2.7, P-2.8, P-2.9, P-3, P-4, P-5, P-6, P-7, R-3, S-1, S-2)
5.469	98	Paved parking, HSG D (P-1, P-2.1, P-2.10, P-2.11, P-2.12, P-2.2, P-2.3, P-2.4, P-2.5, P-2.6, P-2.7, P-2.8, P-2.9, P-3, P-4, P-5, P-6, P-7, R-3, S-1, S-2)
3.022	98	Roofs, HSG D (P-1, P-2.8, P-2.9, P-3, P-4, P-6, P-7, R-1, R-2, R-3, R-4, R-5, R-6)
2.518	77	Woods, Good, HSG D (P-1, P-2, P-2.10, P-3, P-6, P-7, S-1, S-2)

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.91 cfs @ 12.60 hrs, Volume= 0.137 af, Depth= 1.31"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
5,634	80	>75% Grass cover, Good, HSG D
139	98	Paved parking, HSG D
3,124	98	Roofs, HSG D
46,042	77	Woods, Good, HSG D
54,939	79	Weighted Average
51,676		94.06% Pervious Area
3,263		5.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 1.56 cfs @ 12.19 hrs, Volume= 0.146 af, Depth= 1.18"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
8,544	80	>75% Grass cover, Good, HSG D
55,791	77	Woods, Good, HSG D
64,335	77	Weighted Average
64,335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
0.8	60	0.0700	1.32		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
13.1	110	Total			

Summary for Subcatchment P-2.1: Subcat P-2.1

Runoff = 0.17 cfs @ 12.09 hrs, Volume= 0.013 af, Depth= 2.71"
Routed to Reach 2R-1 : new 12" west

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
331	80	>75% Grass cover, Good, HSG D
2,258	98	Paved parking, HSG D
2,588	96	Weighted Average
331		12.77% Pervious Area
2,258		87.23% Impervious Area

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

Summary for Subcatchment P-2.10: Subcat P-2.10

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 0.030 af, Depth= 2.71"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
589	80	>75% Grass cover, Good, HSG D
5,180	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
5,771	96	Weighted Average
591		10.24% Pervious Area
5,180		89.76% Impervious Area

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

Summary for Subcatchment P-2.11: Subcat P-2.11

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.045 af, Depth= 2.41"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
2,481	80	>75% Grass cover, Good, HSG D
7,185	98	Paved parking, HSG D
9,666	93	Weighted Average
2,481		25.67% Pervious Area
7,185		74.33% Impervious Area

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

Summary for Subcatchment P-2.12: Subcat P-2.12

Runoff = 0.54 cfs @ 12.16 hrs, Volume= 0.047 af, Depth= 2.13"
Routed to Reach 1R-6 : New 24" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
5,178	80	>75% Grass cover, Good, HSG D
6,362	98	Paved parking, HSG D
11,539	90	Weighted Average
5,178		44.87% Pervious Area
6,362		55.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.5	50	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.7	150	Total			

Summary for Subcatchment P-2.2: Subcat P-2.2

Runoff = 0.87 cfs @ 12.09 hrs, Volume= 0.066 af, Depth= 2.51"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
2,863	80	>75% Grass cover, Good, HSG D
10,953	98	Paved parking, HSG D
13,816	94	Weighted Average
2,863		20.72% Pervious Area
10,953		79.28% Impervious Area

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

Summary for Subcatchment P-2.3: Subcat P-2.3

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 0.043 af, Depth= 2.41"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
2,462	80	>75% Grass cover, Good, HSG D
6,825	98	Paved parking, HSG D
9,287	93	Weighted Average
2,462		26.51% Pervious Area
6,825		73.49% Impervious Area

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

Summary for Subcatchment P-2.4: Subcat P-2.4

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.039 af, Depth= 2.71"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
957	80	>75% Grass cover, Good, HSG D
6,529	98	Paved parking, HSG D
7,486	96	Weighted Average
957		12.79% Pervious Area
6,529		87.21% Impervious Area

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

Summary for Subcatchment P-2.5: Subcat P-2.5

Runoff = 0.88 cfs @ 12.16 hrs, Volume= 0.078 af, Depth= 2.41"
Routed to Reach 2R-5 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
5,018	80	>75% Grass cover, Good, HSG D
11,943	98	Paved parking, HSG D
16,961	93	Weighted Average
5,018		29.59% Pervious Area
11,943		70.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.4	40	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.6	70	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.8	160	Total			

Summary for Subcatchment P-2.6: Subcat P-2.6

Runoff = 0.67 cfs @ 12.09 hrs, Volume= 0.051 af, Depth= 2.51"
Routed to Reach 1R-2 : New 18" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
2,316	80	>75% Grass cover, Good, HSG D
8,330	98	Paved parking, HSG D
10,646	94	Weighted Average
2,316		21.75% Pervious Area
8,330		78.25% Impervious Area

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

Summary for Subcatchment P-2.7: Subcat P-2.7

Runoff = 0.36 cfs @ 12.09 hrs, Volume= 0.028 af, Depth= 2.51"
Routed to Pond 8P : East Rv Chambers #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
1,329	80	>75% Grass cover, Good, HSG D
4,444	98	Paved parking, HSG D
5,773	94	Weighted Average
1,329		23.03% Pervious Area
4,444		76.97% Impervious Area

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

Summary for Subcatchment P-2.8: Subcat P-2.8

Runoff = 0.88 cfs @ 12.09 hrs, Volume= 0.068 af, Depth= 2.71"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
1,303	80	>75% Grass cover, Good, HSG D
10,068	98	Paved parking, HSG D
1,828	98	Roofs, HSG D
13,200	96	Weighted Average
1,303		9.87% Pervious Area
11,897		90.13% Impervious Area

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

Summary for Subcatchment P-2.9: Subcat P-2.9

Runoff = 0.88 cfs @ 12.09 hrs, Volume= 0.068 af, Depth= 2.71"
Routed to Pond 9P : East Rv Chambers #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
1,139	80	>75% Grass cover, Good, HSG D
10,770	98	Paved parking, HSG D
1,296	98	Roofs, HSG D
13,204	96	Weighted Average
1,139		8.62% Pervious Area
12,066		91.38% Impervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 2.33 cfs @ 12.09 hrs, Volume= 0.182 af, Depth= 2.71"
Routed to Reach 1R-1 : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
1,404	80	>75% Grass cover, Good, HSG D
21,361	98	Paved parking, HSG D
9,936	98	Roofs, HSG D
2,445	77	Woods, Good, HSG D
35,147	96	Weighted Average
3,849		10.95% Pervious Area
31,297		89.05% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 2.04 cfs @ 12.09 hrs, Volume= 0.159 af, Depth= 2.71"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
4,139	80	>75% Grass cover, Good, HSG D
16,618	98	Paved parking, HSG D
9,994	98	Roofs, HSG D
30,751	96	Weighted Average
4,139		13.46% Pervious Area
26,612		86.54% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 1.98 cfs @ 12.09 hrs, Volume= 0.152 af, Depth= 2.61"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
5,035	80	>75% Grass cover, Good, HSG D
25,502	98	Paved parking, HSG D
30,538	95	Weighted Average
5,035		16.49% Pervious Area
25,502		83.51% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 3.91 cfs @ 12.10 hrs, Volume= 0.290 af, Depth= 2.13"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
27,925	80	>75% Grass cover, Good, HSG D
21,097	98	Paved parking, HSG D
19,622	98	Roofs, HSG D
2,432	77	Woods, Good, HSG D
71,076	90	Weighted Average
30,357		42.71% Pervious Area
40,719		57.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.5	48	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
6.4	136	Total			

Summary for Subcatchment P-7: Subcat P-7

Runoff = 4.40 cfs @ 12.17 hrs, Volume= 0.397 af, Depth= 2.41"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
20,862	80	>75% Grass cover, Good, HSG D
42,998	98	Paved parking, HSG D
19,710	98	Roofs, HSG D
2,606	77	Woods, Good, HSG D
86,176	93	Weighted Average
23,468		27.23% Pervious Area
62,708		72.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.7	70	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	100	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
12.3	220	Total			

Summary for Subcatchment R-1: Subcat R-1

Runoff = 0.99 cfs @ 12.00 hrs, Volume= 0.069 af, Depth= 2.93"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
12,335	98	Roofs, HSG D
12,335		100.00% Impervious Area

Summary for Subcatchment R-2: Subcat R-2

Runoff = 1.27 cfs @ 12.00 hrs, Volume= 0.088 af, Depth= 2.93"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
15,710	98	Roofs, HSG D
15,710		100.00% Impervious Area

Summary for Subcatchment R-3: Subcat R-3

Runoff = 2.50 cfs @ 12.00 hrs, Volume= 0.162 af, Depth= 2.51"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
5,750	98	Paved parking, HSG D
20,030	98	Roofs, HSG D
33,729	94	Weighted Average
7,950		23.57% Pervious Area
25,779		76.43% Impervious Area

Summary for Subcatchment R-4: Subcat R-4

Runoff = 0.41 cfs @ 12.00 hrs, Volume= 0.029 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
5,126	98	Roofs, HSG D
5,126		100.00% Impervious Area

Summary for Subcatchment R-5: Subcat R-5

Runoff = 0.66 cfs @ 12.00 hrs, Volume= 0.046 af, Depth= 2.93"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
8,150	98	Roofs, HSG D
8,150		100.00% Impervious Area

Summary for Subcatchment R-6: Subcat R-6

Runoff = 0.39 cfs @ 12.00 hrs, Volume= 0.027 af, Depth= 2.93"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
4,793	98	Roofs, HSG D
4,793		100.00% Impervious Area

Summary for Subcatchment S-1: Subcat S-1

Runoff = 0.45 cfs @ 12.09 hrs, Volume= 0.034 af, Depth= 2.51"
Routed to Pond C9 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
1,304	80	>75% Grass cover, Good, HSG D
5,728	98	Paved parking, HSG D
117	77	Woods, Good, HSG D
7,148	94	Weighted Average
1,420		19.87% Pervious Area
5,728		80.13% Impervious Area

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

Summary for Subcatchment S-2: Subcat S-2

Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.057 af, Depth= 2.22"
Routed to Pond C8 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.16"

Area (sf)	CN	Description
5,013	80	>75% Grass cover, Good, HSG D
8,205	98	Paved parking, HSG D
259	77	Woods, Good, HSG D
13,478	91	Weighted Average
5,272		39.12% Pervious Area
8,205		60.88% Impervious Area

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

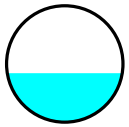
Summary for Reach 1R-1: Ex. 18" RCP

Inflow Area = 0.807 ac, 89.05% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 2.33 cfs @ 12.09 hrs, Volume= 0.182 af
Outflow = 2.28 cfs @ 12.10 hrs, Volume= 0.182 af, Atten= 2%, Lag= 1.0 min
Routed to Reach 1R-2 : New 18" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.32 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.09 fps, Avg. Travel Time= 1.8 min

Peak Storage= 84 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.63' , Surface Width= 1.48'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.36 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 120.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 187.72'



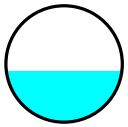
Summary for Reach 1R-2: New 18" ADS

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 2.66" for 2-Year event
Inflow = 2.94 cfs @ 12.10 hrs, Volume= 0.233 af
Outflow = 2.87 cfs @ 12.11 hrs, Volume= 0.233 af, Atten= 2%, Lag= 0.8 min
Routed to Reach 1R-3 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.94 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.30 fps, Avg. Travel Time= 1.5 min

Peak Storage= 87 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.66' , Surface Width= 1.49'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 7.38 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 116.0' Slope= 0.0035 '/'
Inlet Invert= 187.70', Outlet Invert= 187.29'



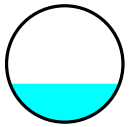
Summary for Reach 1R-3: new 24"

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 2.66" for 2-Year event
Inflow = 2.87 cfs @ 12.11 hrs, Volume= 0.233 af
Outflow = 2.71 cfs @ 12.17 hrs, Volume= 0.233 af, Atten= 6%, Lag= 3.2 min
Routed to Reach 1R-4 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.10 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.00 fps, Avg. Travel Time= 5.2 min

Peak Storage= 283 cf @ 12.14 hrs
Average Depth at Peak Storage= 0.66' , Surface Width= 1.88'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 315.0' Slope= 0.0020 '/'
Inlet Invert= 187.20', Outlet Invert= 186.57'



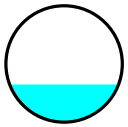
Summary for Reach 1R-4: new 24"

Inflow Area = 2.073 ac, 89.00% Impervious, Inflow Depth = 1.39" for 2-Year event
Inflow = 2.71 cfs @ 12.17 hrs, Volume= 0.240 af
Outflow = 2.64 cfs @ 12.19 hrs, Volume= 0.240 af, Atten= 3%, Lag= 1.7 min
Routed to Reach 1R-5 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.06 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.01 fps, Avg. Travel Time= 2.7 min

Peak Storage= 140 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.64' , Surface Width= 1.87'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 160.0' Slope= 0.0020 '/'
Inlet Invert= 186.50', Outlet Invert= 186.18'



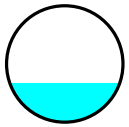
Summary for Reach 1R-5: new 24"

Inflow Area = 2.428 ac, 87.70% Impervious, Inflow Depth = 1.55" for 2-Year event
Inflow = 3.27 cfs @ 12.17 hrs, Volume= 0.314 af
Outflow = 3.25 cfs @ 12.18 hrs, Volume= 0.314 af, Atten= 1%, Lag= 0.8 min
Routed to Reach 1R-6 : New 24" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.52 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 1.4 min

Peak Storage= 88 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.67' , Surface Width= 1.89'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.44 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 95.0' Slope= 0.0025 '/'
Inlet Invert= 186.08', Outlet Invert= 185.84'



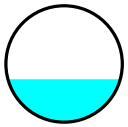
Summary for Reach 1R-6: New 24" ADS

Inflow Area = 2.692 ac, 84.49% Impervious, Inflow Depth = 1.61" for 2-Year event
Inflow = 3.77 cfs @ 12.18 hrs, Volume= 0.361 af
Outflow = 3.76 cfs @ 12.19 hrs, Volume= 0.361 af, Atten= 0%, Lag= 0.4 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.60 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.19 fps, Avg. Travel Time= 0.7 min

Peak Storage= 52 cf @ 12.18 hrs
Average Depth at Peak Storage= 0.73' , Surface Width= 1.93'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.10 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 50.0' Slope= 0.0024 '/'
Inlet Invert= 185.70', Outlet Invert= 185.58'



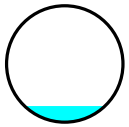
Summary for Reach 2R-1: new 12" west

Inflow Area = 0.059 ac, 87.23% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 0.013 af
Outflow = 0.16 cfs @ 12.11 hrs, Volume= 0.013 af, Atten= 4%, Lag= 1.6 min
Routed to Reach 2R-2 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.63 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 2.9 min

Peak Storage= 10 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.14' , Surface Width= 0.69'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0100 '/'
Inlet Invert= 189.80', Outlet Invert= 188.30'



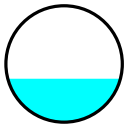
Summary for Reach 2R-2: new 12"

Inflow Area = 0.487 ac, 84.93% Impervious, Inflow Depth = 2.63" for 2-Year event
Inflow = 1.24 cfs @ 12.07 hrs, Volume= 0.106 af
Outflow = 1.23 cfs @ 12.08 hrs, Volume= 0.106 af, Atten= 1%, Lag= 0.5 min
Routed to Reach 2R-3 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.64 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.51 fps, Avg. Travel Time= 0.8 min

Peak Storage= 20 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.37' , Surface Width= 0.97'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 75.0' Slope= 0.0100 '/'
Inlet Invert= 188.10', Outlet Invert= 187.35'



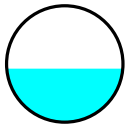
Summary for Reach 2R-3: new 12"

Inflow Area = 0.887 ac, 85.36% Impervious, Inflow Depth = 2.64" for 2-Year event
Inflow = 2.22 cfs @ 12.06 hrs, Volume= 0.195 af
Outflow = 2.21 cfs @ 12.06 hrs, Volume= 0.195 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 2R-4 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.32 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 0.6 min

Peak Storage= 28 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.46' , Surface Width= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.16 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 80.0' Slope= 0.0150 '/'
Inlet Invert= 187.25', Outlet Invert= 186.05'



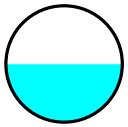
Summary for Reach 2R-4: new 18"

Inflow Area = 1.833 ac, 81.76% Impervious, Inflow Depth = 2.59" for 2-Year event
Inflow = 4.86 cfs @ 12.02 hrs, Volume= 0.395 af
Outflow = 4.70 cfs @ 12.04 hrs, Volume= 0.395 af, Atten= 3%, Lag= 1.2 min
Routed to Reach 2R-5 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.40 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.75 fps, Avg. Travel Time= 1.4 min

Peak Storage= 132 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.75' , Surface Width= 1.50'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 9.62 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0060 '/'
Inlet Invert= 186.80', Outlet Invert= 185.90'



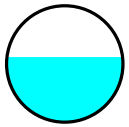
Summary for Reach 2R-5: new 18"

Inflow Area = 2.222 ac, 79.77% Impervious, Inflow Depth = 2.56" for 2-Year event
Inflow = 5.25 cfs @ 12.05 hrs, Volume= 0.473 af
Outflow = 5.24 cfs @ 12.05 hrs, Volume= 0.473 af, Atten= 0%, Lag= 0.3 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.19 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.72 fps, Avg. Travel Time= 0.6 min

Peak Storage= 61 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.84' , Surface Width= 1.49'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 8.78 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 60.0' Slope= 0.0050 '/'
Inlet Invert= 185.90', Outlet Invert= 185.60'



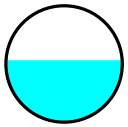
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 2.04 cfs @ 12.09 hrs, Volume= 0.159 af
Outflow = 2.03 cfs @ 12.09 hrs, Volume= 0.159 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.82 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.63 fps, Avg. Travel Time= 0.7 min

Peak Storage= 27 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.53' , Surface Width= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



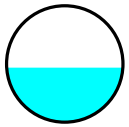
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 2.03 cfs @ 12.09 hrs, Volume= 0.159 af
Outflow = 2.01 cfs @ 12.10 hrs, Volume= 0.159 af, Atten= 1%, Lag= 0.3 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.61 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.21 fps, Avg. Travel Time= 0.6 min

Peak Storage= 25 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.58' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



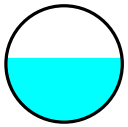
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 2.38" for 2-Year event
Inflow = 7.90 cfs @ 12.09 hrs, Volume= 0.601 af
Outflow = 7.69 cfs @ 12.11 hrs, Volume= 0.601 af, Atten= 3%, Lag= 0.9 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.44 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.44 fps, Avg. Travel Time= 1.8 min

Peak Storage= 274 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.10' , Surface Width= 1.99'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



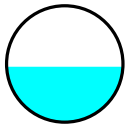
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 2.38" for 2-Year event
Inflow = 7.69 cfs @ 12.11 hrs, Volume= 0.601 af
Outflow = 7.40 cfs @ 12.13 hrs, Volume= 0.601 af, Atten= 4%, Lag= 1.4 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.16 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.67 fps, Avg. Travel Time= 2.2 min

Peak Storage= 318 cf @ 12.12 hrs
Average Depth at Peak Storage= 0.95' , Surface Width= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Pond 5P: East Rv Chambers #2

Inflow Area = 0.586 ac, 94.90% Impervious, Inflow Depth = 2.81" for 2-Year event
Inflow = 1.59 cfs @ 12.03 hrs, Volume= 0.138 af
Outflow = 0.07 cfs @ 9.90 hrs, Volume= 0.138 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.07 cfs @ 9.90 hrs, Volume= 0.138 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 188.81' @ 14.94 hrs Surf.Area= 3,025 sf Storage= 3,042 cf

Plug-Flow detention time= 371.2 min calculated for 0.137 af (100% of inflow)
Center-of-Mass det. time= 371.2 min (1,133.9 - 762.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	2,257 cf	**17.08'W x 177.08'L x 2.33'H Field A** 7,059 cf Overall - 1,415 cf Embedded = 5,643 cf x 40.0% Voids
#2A	187.50'	1,415 cf	**ADS_StormTech SC-310 +Cap** x 96 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 96 Chambers in 4 Rows
		3,673 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.07 cfs @ 9.90 hrs HW=187.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
↑**2=RCP_Round 12"** (Controls 0.00 cfs)

Pond 5P: East Rv Chambers #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

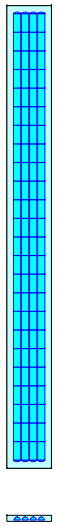
24 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 172.08' Row Length +30.0" End Stone x 2 = 177.08' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

96 Chambers x 14.7 cf = 1,415.2 cf Chamber Storage

7,058.6 cf Field - 1,415.2 cf Chambers = 5,643.4 cf Stone x 40.0% Voids = 2,257.4 cf Stone Storage

Chamber Storage + Stone Storage = 3,672.6 cf = 0.084 af
Overall Storage Efficiency = 52.0%
Overall System Size = 177.08' x 17.08' x 2.33'

96 Chambers
261.4 cy Field
209.0 cy Stone



Summary for Pond 8P: East Rv Chambers #1

Inflow Area = 0.133 ac, 76.97% Impervious, Inflow Depth = 2.51" for 2-Year event
Inflow = 0.36 cfs @ 12.09 hrs, Volume= 0.028 af
Outflow = 0.04 cfs @ 11.60 hrs, Volume= 0.028 af, Atten= 90%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.60 hrs, Volume= 0.028 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 187.61' @ 12.88 hrs Surf.Area= 1,566 sf Storage= 441 cf

Plug-Flow detention time= 90.7 min calculated for 0.028 af (100% of inflow)
Center-of-Mass det. time= 90.6 min (878.2 - 787.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,178 cf	**17.08'W x 91.64'L x 2.33'H Field A** 3,653 cf Overall - 708 cf Embedded = 2,945 cf x 40.0% Voids
#2A	187.50'	708 cf	**ADS_StormTech SC-310 +Cap** x 48 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 48 Chambers in 4 Rows
		1,886 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.04 cfs @ 11.60 hrs HW=187.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
└**2=RCP_Round 12"** (Controls 0.00 cfs)

Pond 8P: East Rv Chambers #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

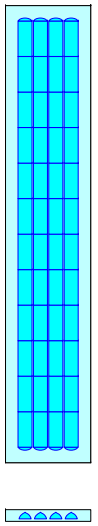
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

48 Chambers x 14.7 cf = 707.6 cf Chamber Storage

3,652.9 cf Field - 707.6 cf Chambers = 2,945.3 cf Stone x 40.0% Voids = 1,178.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,885.7 cf = 0.043 af
Overall Storage Efficiency = 51.6%
Overall System Size = 91.64' x 17.08' x 2.33'

48 Chambers
135.3 cy Field
109.1 cy Stone



Summary for Pond 9P: East Rv Chambers #3

Inflow Area = 0.303 ac, 91.38% Impervious, Inflow Depth = 2.71" for 2-Year event
Inflow = 0.88 cfs @ 12.09 hrs, Volume= 0.068 af
Outflow = 0.09 cfs @ 12.87 hrs, Volume= 0.068 af, Atten= 90%, Lag= 46.9 min
Discarded = 0.03 cfs @ 9.70 hrs, Volume= 0.062 af
Primary = 0.06 cfs @ 12.87 hrs, Volume= 0.006 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 189.00' @ 12.87 hrs Surf.Area= 1,322 sf Storage= 1,411 cf

Plug-Flow detention time= 360.4 min calculated for 0.068 af (100% of inflow)
Center-of-Mass det. time= 360.6 min (1,135.0 - 774.4)

Volume	Invert	Avail.Storage	Storage Description
#1B	187.00'	998 cf	**17.08'W x 77.40'L x 2.33'H Field B** 3,085 cf Overall - 590 cf Embedded = 2,496 cf x 40.0% Voids
#2B	187.50'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows
		1,588 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.03 cfs @ 9.70 hrs HW=187.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.06 cfs @ 12.87 hrs HW=189.00' (Free Discharge)
↑**2=RCP_Round 12"** (Inlet Controls 0.06 cfs @ 0.96 fps)

Pond 9P: East Rv Chambers #3 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

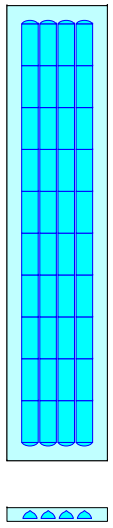
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

3,085.2 cf Field - 589.7 cf Chambers = 2,495.6 cf Stone x 40.0% Voids = 998.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,587.9 cf = 0.036 af
Overall Storage Efficiency = 51.5%
Overall System Size = 77.40' x 17.08' x 2.33'

40 Chambers
114.3 cy Field
92.4 cy Stone



Summary for Pond C8: Banked Parking chambers

Inflow Area = 0.309 ac, 60.88% Impervious, Inflow Depth = 2.22" for 2-Year event
Inflow = 0.78 cfs @ 12.09 hrs, Volume= 0.057 af
Outflow = 0.07 cfs @ 11.60 hrs, Volume= 0.057 af, Atten= 91%, Lag= 0.0 min
Discarded = 0.07 cfs @ 11.60 hrs, Volume= 0.057 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 189.66' @ 13.03 hrs Surf.Area= 2,978 sf Storage= 970 cf

Plug-Flow detention time= 113.0 min calculated for 0.057 af (100% of inflow)
Center-of-Mass det. time= 112.8 min (915.8 - 802.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	189.00'	2,143 cf	**32.50'W x 91.64'L x 2.33'H Field A** 6,949 cf Overall - 1,592 cf Embedded = 5,357 cf x 40.0% Voids
#2A	189.50'	1,592 cf	**ADS_StormTech SC-310 +Cap** x 108 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 108 Chambers in 9 Rows
		3,735 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	189.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	191.00'	**8.0" Round Culvert X 2.00** L= 48.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.00' / 190.04' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 11.60 hrs HW=189.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=189.00' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond C8: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

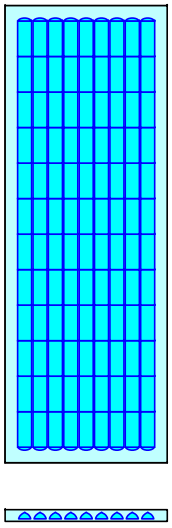
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
9 Rows x 34.0" Wide + 3.0" Spacing x 8 + 30.0" Side Stone x 2 = 32.50' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

108 Chambers x 14.7 cf = 1,592.1 cf Chamber Storage

6,949.4 cf Field - 1,592.1 cf Chambers = 5,357.2 cf Stone x 40.0% Voids = 2,142.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,735.0 cf = 0.086 af
Overall Storage Efficiency = 53.7%
Overall System Size = 91.64' x 32.50' x 2.33'

108 Chambers
257.4 cy Field
198.4 cy Stone



Summary for Pond C9: Banked Parking chambers

Inflow Area = 0.164 ac, 80.13% Impervious, Inflow Depth = 2.51" for 2-Year event
Inflow = 0.45 cfs @ 12.09 hrs, Volume= 0.034 af
Outflow = 0.04 cfs @ 11.45 hrs, Volume= 0.034 af, Atten= 92%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.45 hrs, Volume= 0.034 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 187.25' @ 13.10 hrs Surf.Area= 1,561 sf Storage= 591 cf

Plug-Flow detention time= 129.6 min calculated for 0.034 af (100% of inflow)
Center-of-Mass det. time= 129.4 min (917.0 - 787.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	186.50'	1,162 cf	**20.17'W x 77.40'L x 2.33'H Field A** 3,642 cf Overall - 737 cf Embedded = 2,905 cf x 40.0% Voids
#2A	187.00'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 5 Rows
		1,899 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	186.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.50'	**8.0" Round Culvert X 2.00** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.50' / 187.90' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.04 cfs @ 11.45 hrs HW=186.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=186.50' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Pond C9: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

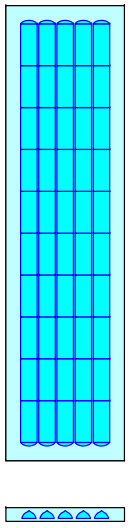
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
5 Rows x 34.0" Wide + 3.0" Spacing x 4 + 30.0" Side Stone x 2 = 20.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,642.1 cf Field - 737.1 cf Chambers = 2,905.0 cf Stone x 40.0% Voids = 1,162.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,899.1 cf = 0.044 af
Overall Storage Efficiency = 52.1%
Overall System Size = 77.40' x 20.17' x 2.33'

50 Chambers
134.9 cy Field
107.6 cy Stone



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 1.978 ac, 72.77% Impervious, Inflow Depth = 2.41" for 2-Year event
Inflow = 4.40 cfs @ 12.17 hrs, Volume= 0.397 af
Primary = 4.40 cfs @ 12.17 hrs, Volume= 0.397 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

Inflow Area = 10.265 ac, 66.83% Impervious, Inflow Depth = 1.95" for 2-Year event
Inflow = 17.30 cfs @ 12.13 hrs, Volume= 1.670 af
Primary = 17.30 cfs @ 12.13 hrs, Volume= 1.670 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

Inflow Area = 1.261 ac, 5.94% Impervious, Inflow Depth = 1.31" for 2-Year event
Inflow = 0.91 cfs @ 12.60 hrs, Volume= 0.137 af
Primary = 0.91 cfs @ 12.60 hrs, Volume= 0.137 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 14L: Outflow of Combined INF Systems

Inflow Area = 1.022 ac, 91.53% Impervious, Inflow Depth = 0.07" for 2-Year event
Inflow = 0.06 cfs @ 12.87 hrs, Volume= 0.006 af
Primary = 0.06 cfs @ 12.87 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R-4 : new 24"

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Subcatchment P-1: Subcat P-1

Runoff = 1.85 cfs @ 12.58 hrs, Volume= 0.274 af, Depth= 2.60"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
5,634	80	>75% Grass cover, Good, HSG D
139	98	Paved parking, HSG D
3,124	98	Roofs, HSG D
46,042	77	Woods, Good, HSG D
54,939	79	Weighted Average
51,676		94.06% Pervious Area
3,263		5.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 3.31 cfs @ 12.19 hrs, Volume= 0.299 af, Depth= 2.43"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
8,544	80	>75% Grass cover, Good, HSG D
55,791	77	Woods, Good, HSG D
64,335	77	Weighted Average
64,335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
0.8	60	0.0700	1.32		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
13.1	110	Total			

Summary for Subcatchment P-2.1: Subcat P-2.1

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 0.021 af, Depth= 4.30"
Routed to Reach 2R-1 : new 12" west

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
331	80	>75% Grass cover, Good, HSG D
2,258	98	Paved parking, HSG D
2,588	96	Weighted Average
331		12.77% Pervious Area
2,258		87.23% Impervious Area

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

Summary for Subcatchment P-2.10: Subcat P-2.10

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.048 af, Depth= 4.30"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
589	80	>75% Grass cover, Good, HSG D
5,180	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
5,771	96	Weighted Average
591		10.24% Pervious Area
5,180		89.76% Impervious Area

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

Summary for Subcatchment P-2.11: Subcat P-2.11

Runoff = 0.95 cfs @ 12.09 hrs, Volume= 0.073 af, Depth= 3.97"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
2,481	80	>75% Grass cover, Good, HSG D
7,185	98	Paved parking, HSG D
9,666	93	Weighted Average
2,481		25.67% Pervious Area
7,185		74.33% Impervious Area

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

Summary for Subcatchment P-2.12: Subcat P-2.12

Runoff = 0.91 cfs @ 12.16 hrs, Volume= 0.081 af, Depth= 3.65"
Routed to Reach 1R-6 : New 24" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
5,178	80	>75% Grass cover, Good, HSG D
6,362	98	Paved parking, HSG D
11,539	90	Weighted Average
5,178		44.87% Pervious Area
6,362		55.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.5	50	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.7	150	Total			

Summary for Subcatchment P-2.2: Subcat P-2.2

Runoff = 1.38 cfs @ 12.09 hrs, Volume= 0.108 af, Depth= 4.08"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
2,863	80	>75% Grass cover, Good, HSG D
10,953	98	Paved parking, HSG D
13,816	94	Weighted Average
2,863		20.72% Pervious Area
10,953		79.28% Impervious Area

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

Summary for Subcatchment P-2.3: Subcat P-2.3

Runoff = 0.91 cfs @ 12.09 hrs, Volume= 0.071 af, Depth= 3.97"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
2,462	80	>75% Grass cover, Good, HSG D
6,825	98	Paved parking, HSG D
9,287	93	Weighted Average
2,462		26.51% Pervious Area
6,825		73.49% Impervious Area

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

Summary for Subcatchment P-2.4: Subcat P-2.4

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 0.062 af, Depth= 4.30"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
957	80	>75% Grass cover, Good, HSG D
6,529	98	Paved parking, HSG D
7,486	96	Weighted Average
957		12.79% Pervious Area
6,529		87.21% Impervious Area

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

Summary for Subcatchment P-2.5: Subcat P-2.5

Runoff = 1.41 cfs @ 12.16 hrs, Volume= 0.129 af, Depth= 3.97"
Routed to Reach 2R-5 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
5,018	80	>75% Grass cover, Good, HSG D
11,943	98	Paved parking, HSG D
16,961	93	Weighted Average
5,018		29.59% Pervious Area
11,943		70.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.4	40	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.6	70	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.8	160	Total			

Summary for Subcatchment P-2.6: Subcat P-2.6

Runoff = 1.07 cfs @ 12.09 hrs, Volume= 0.083 af, Depth= 4.08"
Routed to Reach 1R-2 : New 18" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
2,316	80	>75% Grass cover, Good, HSG D
8,330	98	Paved parking, HSG D
10,646	94	Weighted Average
2,316		21.75% Pervious Area
8,330		78.25% Impervious Area

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

Summary for Subcatchment P-2.7: Subcat P-2.7

Runoff = 0.58 cfs @ 12.09 hrs, Volume= 0.045 af, Depth= 4.08"
Routed to Pond 8P : East Rv Chambers #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
1,329	80	>75% Grass cover, Good, HSG D
4,444	98	Paved parking, HSG D
5,773	94	Weighted Average
1,329		23.03% Pervious Area
4,444		76.97% Impervious Area

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

Summary for Subcatchment P-2.8: Subcat P-2.8

Runoff = 1.36 cfs @ 12.09 hrs, Volume= 0.109 af, Depth= 4.30"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
1,303	80	>75% Grass cover, Good, HSG D
10,068	98	Paved parking, HSG D
1,828	98	Roofs, HSG D
13,200	96	Weighted Average
1,303		9.87% Pervious Area
11,897		90.13% Impervious Area

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

Summary for Subcatchment P-2.9: Subcat P-2.9

Runoff = 1.36 cfs @ 12.09 hrs, Volume= 0.109 af, Depth= 4.30"
Routed to Pond 9P : East Rv Chambers #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
1,139	80	>75% Grass cover, Good, HSG D
10,770	98	Paved parking, HSG D
1,296	98	Roofs, HSG D
13,204	96	Weighted Average
1,139		8.62% Pervious Area
12,066		91.38% Impervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 3.61 cfs @ 12.09 hrs, Volume= 0.289 af, Depth= 4.30"
Routed to Reach 1R-1 : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
1,404	80	>75% Grass cover, Good, HSG D
21,361	98	Paved parking, HSG D
9,936	98	Roofs, HSG D
2,445	77	Woods, Good, HSG D
35,147	96	Weighted Average
3,849		10.95% Pervious Area
31,297		89.05% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 3.16 cfs @ 12.09 hrs, Volume= 0.253 af, Depth= 4.30"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
4,139	80	>75% Grass cover, Good, HSG D
16,618	98	Paved parking, HSG D
9,994	98	Roofs, HSG D
30,751	96	Weighted Average
4,139		13.46% Pervious Area
26,612		86.54% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 3.10 cfs @ 12.09 hrs, Volume= 0.245 af, Depth= 4.19"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
5,035	80	>75% Grass cover, Good, HSG D
25,502	98	Paved parking, HSG D
30,538	95	Weighted Average
5,035		16.49% Pervious Area
25,502		83.51% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 6.55 cfs @ 12.09 hrs, Volume= 0.497 af, Depth= 3.65"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
27,925	80	>75% Grass cover, Good, HSG D
21,097	98	Paved parking, HSG D
19,622	98	Roofs, HSG D
2,432	77	Woods, Good, HSG D
71,076	90	Weighted Average
30,357		42.71% Pervious Area
40,719		57.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.5	48	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
6.4	136	Total			

Summary for Subcatchment P-7: Subcat P-7

Runoff = 7.07 cfs @ 12.16 hrs, Volume= 0.655 af, Depth= 3.97"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
20,862	80	>75% Grass cover, Good, HSG D
42,998	98	Paved parking, HSG D
19,710	98	Roofs, HSG D
2,606	77	Woods, Good, HSG D
86,176	93	Weighted Average
23,468		27.23% Pervious Area
62,708		72.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.7	70	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	100	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
12.3	220	Total			

Summary for Subcatchment R-1: Subcat R-1

Runoff = 1.51 cfs @ 12.00 hrs, Volume= 0.107 af, Depth= 4.53"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
12,335	98	Roofs, HSG D
12,335		100.00% Impervious Area

Summary for Subcatchment R-2: Subcat R-2

Runoff = 1.92 cfs @ 12.00 hrs, Volume= 0.136 af, Depth= 4.53"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
15,710	98	Roofs, HSG D
15,710		100.00% Impervious Area

Summary for Subcatchment R-3: Subcat R-3

Runoff = 3.96 cfs @ 12.00 hrs, Volume= 0.263 af, Depth= 4.08"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
5,750	98	Paved parking, HSG D
20,030	98	Roofs, HSG D
33,729	94	Weighted Average
7,950		23.57% Pervious Area
25,779		76.43% Impervious Area

Summary for Subcatchment R-4: Subcat R-4

Runoff = 0.63 cfs @ 12.00 hrs, Volume= 0.044 af, Depth= 4.53"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
5,126	98	Roofs, HSG D
5,126		100.00% Impervious Area

Summary for Subcatchment R-5: Subcat R-5

Runoff = 1.00 cfs @ 12.00 hrs, Volume= 0.071 af, Depth= 4.53"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
8,150	98	Roofs, HSG D
8,150		100.00% Impervious Area

Summary for Subcatchment R-6: Subcat R-6

Runoff = 0.59 cfs @ 12.00 hrs, Volume= 0.042 af, Depth= 4.53"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
4,793	98	Roofs, HSG D
4,793		100.00% Impervious Area

Summary for Subcatchment S-1: Subcat S-1

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 4.08"
Routed to Pond C9 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
1,304	80	>75% Grass cover, Good, HSG D
5,728	98	Paved parking, HSG D
117	77	Woods, Good, HSG D
7,148	94	Weighted Average
1,420		19.87% Pervious Area
5,728		80.13% Impervious Area

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

Summary for Subcatchment S-2: Subcat S-2

Runoff = 1.28 cfs @ 12.09 hrs, Volume= 0.097 af, Depth= 3.76"
Routed to Pond C8 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.77"

Area (sf)	CN	Description
5,013	80	>75% Grass cover, Good, HSG D
8,205	98	Paved parking, HSG D
259	77	Woods, Good, HSG D
13,478	91	Weighted Average
5,272		39.12% Pervious Area
8,205		60.88% Impervious Area

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

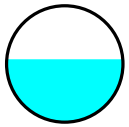
Summary for Reach 1R-1: Ex. 18" RCP

Inflow Area = 0.807 ac, 89.05% Impervious, Inflow Depth = 4.30" for 10-Year event
Inflow = 3.61 cfs @ 12.09 hrs, Volume= 0.289 af
Outflow = 3.54 cfs @ 12.10 hrs, Volume= 0.289 af, Atten= 2%, Lag= 0.9 min
Routed to Reach 1R-2 : New 18" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.71 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.25 fps, Avg. Travel Time= 1.6 min

Peak Storage= 117 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.81' , Surface Width= 1.50'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.36 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 120.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 187.72'



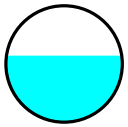
Summary for Reach 1R-2: New 18" ADS

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 4.25" for 10-Year event
Inflow = 4.59 cfs @ 12.10 hrs, Volume= 0.373 af
Outflow = 4.50 cfs @ 12.11 hrs, Volume= 0.373 af, Atten= 2%, Lag= 0.7 min
Routed to Reach 1R-3 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.40 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 1.3 min

Peak Storage= 121 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.86' , Surface Width= 1.48'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 7.38 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 116.0' Slope= 0.0035 '/'
Inlet Invert= 187.70', Outlet Invert= 187.29'



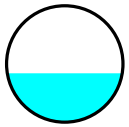
Summary for Reach 1R-3: new 24"

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 4.25" for 10-Year event
Inflow = 4.50 cfs @ 12.11 hrs, Volume= 0.373 af
Outflow = 4.26 cfs @ 12.16 hrs, Volume= 0.373 af, Atten= 5%, Lag= 2.8 min
Routed to Reach 1R-4 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.50 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.14 fps, Avg. Travel Time= 4.6 min

Peak Storage= 393 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.84' , Surface Width= 1.97'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 315.0' Slope= 0.0020 '/'
Inlet Invert= 187.20', Outlet Invert= 186.57'



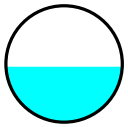
Summary for Reach 1R-4: new 24"

Inflow Area = 2.073 ac, 89.00% Impervious, Inflow Depth = 2.70" for 10-Year event
Inflow = 5.54 cfs @ 12.17 hrs, Volume= 0.466 af
Outflow = 5.42 cfs @ 12.22 hrs, Volume= 0.466 af, Atten= 2%, Lag= 2.5 min
Routed to Reach 1R-5 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.72 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 2.3 min

Peak Storage= 236 cf @ 12.20 hrs
Average Depth at Peak Storage= 0.95' , Surface Width= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 160.0' Slope= 0.0020 '/'
Inlet Invert= 186.50', Outlet Invert= 186.18'



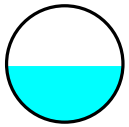
Summary for Reach 1R-5: new 24"

Inflow Area = 2.428 ac, 87.70% Impervious, Inflow Depth = 2.90" for 10-Year event
Inflow = 6.28 cfs @ 12.20 hrs, Volume= 0.587 af
Outflow = 6.25 cfs @ 12.21 hrs, Volume= 0.587 af, Atten= 0%, Lag= 0.6 min
Routed to Reach 1R-6 : New 24" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.21 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.36 fps, Avg. Travel Time= 1.2 min

Peak Storage= 142 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.96' , Surface Width= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.44 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 95.0' Slope= 0.0025 '/'
Inlet Invert= 186.08', Outlet Invert= 185.84'



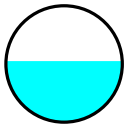
Summary for Reach 1R-6: New 24" ADS

Inflow Area = 2.692 ac, 84.49% Impervious, Inflow Depth = 2.98" for 10-Year event
Inflow = 7.09 cfs @ 12.20 hrs, Volume= 0.668 af
Outflow = 7.07 cfs @ 12.21 hrs, Volume= 0.668 af, Atten= 0%, Lag= 0.3 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.25 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.39 fps, Avg. Travel Time= 0.6 min

Peak Storage= 83 cf @ 12.21 hrs
Average Depth at Peak Storage= 1.05' , Surface Width= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.10 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 50.0' Slope= 0.0024 '/'
Inlet Invert= 185.70', Outlet Invert= 185.58'



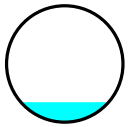
Summary for Reach 2R-1: new 12" west

Inflow Area = 0.059 ac, 87.23% Impervious, Inflow Depth = 4.30" for 10-Year event
Inflow = 0.27 cfs @ 12.09 hrs, Volume= 0.021 af
Outflow = 0.26 cfs @ 12.11 hrs, Volume= 0.021 af, Atten= 3%, Lag= 1.4 min
Routed to Reach 2R-2 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.99 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 2.6 min

Peak Storage= 13 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.17' , Surface Width= 0.75'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0100 '/'
Inlet Invert= 189.80', Outlet Invert= 188.30'



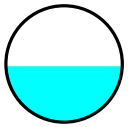
Summary for Reach 2R-2: new 12"

Inflow Area = 0.487 ac, 84.93% Impervious, Inflow Depth = 4.21" for 10-Year event
Inflow = 1.96 cfs @ 12.07 hrs, Volume= 0.171 af
Outflow = 1.94 cfs @ 12.08 hrs, Volume= 0.171 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 2R-3 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.24 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.75 fps, Avg. Travel Time= 0.7 min

Peak Storage= 28 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.48' , Surface Width= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 75.0' Slope= 0.0100 '/'
Inlet Invert= 188.10', Outlet Invert= 187.35'



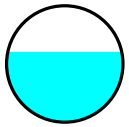
Summary for Reach 2R-3: new 12"

Inflow Area = 0.887 ac, 85.36% Impervious, Inflow Depth = 4.22" for 10-Year event
Inflow = 3.49 cfs @ 12.06 hrs, Volume= 0.312 af
Outflow = 3.48 cfs @ 12.06 hrs, Volume= 0.312 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 2R-4 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.05 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.42 fps, Avg. Travel Time= 0.6 min

Peak Storage= 40 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.60' , Surface Width= 0.98'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.16 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 80.0' Slope= 0.0150 '/'
Inlet Invert= 187.25', Outlet Invert= 186.05'



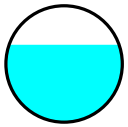
Summary for Reach 2R-4: new 18"

Inflow Area = 1.833 ac, 81.76% Impervious, Inflow Depth = 4.17" for 10-Year event
Inflow = 7.65 cfs @ 12.02 hrs, Volume= 0.637 af
Outflow = 7.41 cfs @ 12.04 hrs, Volume= 0.637 af, Atten= 3%, Lag= 1.1 min
Routed to Reach 2R-5 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.99 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.03 fps, Avg. Travel Time= 1.2 min

Peak Storage= 187 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.00' , Surface Width= 1.42'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 9.62 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0060 '/'
Inlet Invert= 186.80', Outlet Invert= 185.90'



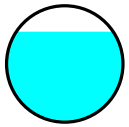
Summary for Reach 2R-5: new 18"

Inflow Area = 2.222 ac, 79.77% Impervious, Inflow Depth = 4.14" for 10-Year event
Inflow = 8.30 cfs @ 12.04 hrs, Volume= 0.766 af
Outflow = 8.29 cfs @ 12.05 hrs, Volume= 0.766 af, Atten= 0%, Lag= 0.4 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.65 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.99 fps, Avg. Travel Time= 0.5 min

Peak Storage= 88 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.17' , Surface Width= 1.25'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 8.78 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 60.0' Slope= 0.0050 '/'
Inlet Invert= 185.90', Outlet Invert= 185.60'



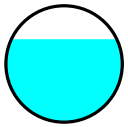
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 4.30" for 10-Year event
Inflow = 3.16 cfs @ 12.09 hrs, Volume= 0.253 af
Outflow = 3.14 cfs @ 12.09 hrs, Volume= 0.253 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.29 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.85 fps, Avg. Travel Time= 0.6 min

Peak Storage= 38 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.71' , Surface Width= 0.91'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



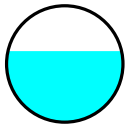
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 4.30" for 10-Year event
Inflow = 3.14 cfs @ 12.09 hrs, Volume= 0.253 af
Outflow = 3.12 cfs @ 12.10 hrs, Volume= 0.253 af, Atten= 1%, Lag= 0.3 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.01 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.37 fps, Avg. Travel Time= 0.5 min

Peak Storage= 34 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.76' , Surface Width= 1.22'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



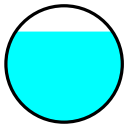
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 3.93" for 10-Year event
Inflow = 12.76 cfs @ 12.09 hrs, Volume= 0.995 af
Outflow = 12.43 cfs @ 12.11 hrs, Volume= 0.995 af, Atten= 3%, Lag= 0.9 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.85 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.66 fps, Avg. Travel Time= 1.5 min

Peak Storage= 404 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.56' , Surface Width= 1.66'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



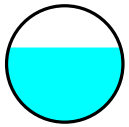
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 3.93" for 10-Year event
Inflow = 12.43 cfs @ 12.11 hrs, Volume= 0.995 af
Outflow = 12.00 cfs @ 12.13 hrs, Volume= 0.995 af, Atten= 3%, Lag= 1.2 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.79 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.92 fps, Avg. Travel Time= 1.9 min

Peak Storage= 459 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.28' , Surface Width= 1.92'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Pond 5P: East Rv Chambers #2

Inflow Area = 0.586 ac, 94.90% Impervious, Inflow Depth = 4.41" for 10-Year event
Inflow = 2.44 cfs @ 12.03 hrs, Volume= 0.216 af
Outflow = 1.58 cfs @ 12.25 hrs, Volume= 0.216 af, Atten= 35%, Lag= 13.5 min
Discarded = 0.07 cfs @ 8.50 hrs, Volume= 0.160 af
Primary = 1.51 cfs @ 12.25 hrs, Volume= 0.056 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 189.73' @ 12.25 hrs Surf.Area= 3,025 sf Storage= 3,673 cf

Plug-Flow detention time= 302.9 min calculated for 0.215 af (100% of inflow)
Center-of-Mass det. time= 303.3 min (1,056.7 - 753.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	2,257 cf	**17.08'W x 177.08'L x 2.33'H Field A** 7,059 cf Overall - 1,415 cf Embedded = 5,643 cf x 40.0% Voids
#2A	187.50'	1,415 cf	**ADS_StormTech SC-310 +Cap** x 96 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 96 Chambers in 4 Rows
		3,673 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.07 cfs @ 8.50 hrs HW=187.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=1.50 cfs @ 12.25 hrs HW=189.73' (Free Discharge)
↑**2=RCP_Round 12"** (Barrel Controls 1.50 cfs @ 2.67 fps)

Pond 5P: East Rv Chambers #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

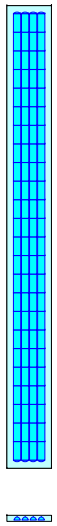
24 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 172.08' Row Length +30.0" End Stone x 2 = 177.08' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

96 Chambers x 14.7 cf = 1,415.2 cf Chamber Storage

7,058.6 cf Field - 1,415.2 cf Chambers = 5,643.4 cf Stone x 40.0% Voids = 2,257.4 cf Stone Storage

Chamber Storage + Stone Storage = 3,672.6 cf = 0.084 af
Overall Storage Efficiency = 52.0%
Overall System Size = 177.08' x 17.08' x 2.33'

96 Chambers
261.4 cy Field
209.0 cy Stone



Summary for Pond 8P: East Rv Chambers #1

Inflow Area = 0.133 ac, 76.97% Impervious, Inflow Depth = 4.08" for 10-Year event
Inflow = 0.58 cfs @ 12.09 hrs, Volume= 0.045 af
Outflow = 0.04 cfs @ 11.05 hrs, Volume= 0.045 af, Atten= 94%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.05 hrs, Volume= 0.045 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 187.99' @ 13.66 hrs Surf.Area= 1,566 sf Storage= 841 cf

Plug-Flow detention time= 189.6 min calculated for 0.045 af (100% of inflow)
Center-of-Mass det. time= 189.3 min (964.2 - 774.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,178 cf	**17.08'W x 91.64'L x 2.33'H Field A** 3,653 cf Overall - 708 cf Embedded = 2,945 cf x 40.0% Voids
#2A	187.50'	708 cf	**ADS_StormTech SC-310 +Cap** x 48 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 48 Chambers in 4 Rows
		1,886 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.04 cfs @ 11.05 hrs HW=187.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
└**2=RCP_Round 12"** (Controls 0.00 cfs)

Pond 8P: East Rv Chambers #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

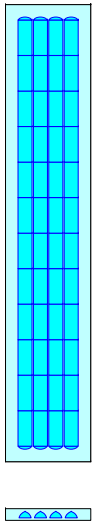
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

48 Chambers x 14.7 cf = 707.6 cf Chamber Storage

3,652.9 cf Field - 707.6 cf Chambers = 2,945.3 cf Stone x 40.0% Voids = 1,178.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,885.7 cf = 0.043 af
Overall Storage Efficiency = 51.6%
Overall System Size = 91.64' x 17.08' x 2.33'

48 Chambers
135.3 cy Field
109.1 cy Stone



Summary for Pond 9P: East Rv Chambers #3

Inflow Area = 0.303 ac, 91.38% Impervious, Inflow Depth = 4.30" for 10-Year event
Inflow = 1.36 cfs @ 12.09 hrs, Volume= 0.109 af
Outflow = 0.98 cfs @ 12.18 hrs, Volume= 0.109 af, Atten= 28%, Lag= 5.6 min
Discarded = 0.03 cfs @ 8.35 hrs, Volume= 0.071 af
Primary = 0.94 cfs @ 12.18 hrs, Volume= 0.038 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 189.52' @ 12.18 hrs Surf.Area= 1,322 sf Storage= 1,588 cf

Plug-Flow detention time= 270.4 min calculated for 0.109 af (100% of inflow)
Center-of-Mass det. time= 270.9 min (1,034.4 - 763.5)

Volume	Invert	Avail.Storage	Storage Description
#1B	187.00'	998 cf	**17.08'W x 77.40'L x 2.33'H Field B** 3,085 cf Overall - 590 cf Embedded = 2,496 cf x 40.0% Voids
#2B	187.50'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows
		1,588 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.03 cfs @ 8.35 hrs HW=187.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.89 cfs @ 12.18 hrs HW=189.49' (Free Discharge)
└**2=RCP_Round 12"** (Barrel Controls 0.89 cfs @ 2.28 fps)

Pond 9P: East Rv Chambers #3 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

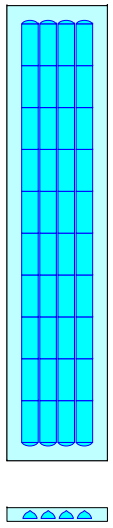
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

3,085.2 cf Field - 589.7 cf Chambers = 2,495.6 cf Stone x 40.0% Voids = 998.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,587.9 cf = 0.036 af
Overall Storage Efficiency = 51.5%
Overall System Size = 77.40' x 17.08' x 2.33'

40 Chambers
114.3 cy Field
92.4 cy Stone



Summary for Pond C8: Banked Parking chambers

Inflow Area = 0.309 ac, 60.88% Impervious, Inflow Depth = 3.76" for 10-Year event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 0.097 af
Outflow = 0.07 cfs @ 10.90 hrs, Volume= 0.097 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.07 cfs @ 10.90 hrs, Volume= 0.097 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 190.12' @ 14.08 hrs Surf.Area= 2,978 sf Storage= 1,965 cf

Plug-Flow detention time= 248.8 min calculated for 0.097 af (100% of inflow)
Center-of-Mass det. time= 248.7 min (1,037.1 - 788.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	189.00'	2,143 cf	**32.50'W x 91.64'L x 2.33'H Field A** 6,949 cf Overall - 1,592 cf Embedded = 5,357 cf x 40.0% Voids
#2A	189.50'	1,592 cf	**ADS_StormTech SC-310 +Cap** x 108 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 108 Chambers in 9 Rows
		3,735 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	189.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	191.00'	**8.0" Round Culvert X 2.00** L= 48.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.00' / 190.04' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 10.90 hrs HW=189.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=189.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Pond C8: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

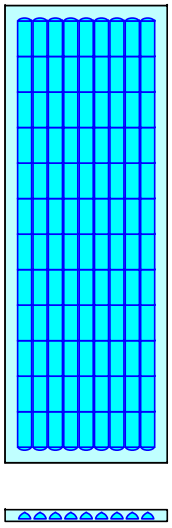
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
9 Rows x 34.0" Wide + 3.0" Spacing x 8 + 30.0" Side Stone x 2 = 32.50' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

108 Chambers x 14.7 cf = 1,592.1 cf Chamber Storage

6,949.4 cf Field - 1,592.1 cf Chambers = 5,357.2 cf Stone x 40.0% Voids = 2,142.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,735.0 cf = 0.086 af
Overall Storage Efficiency = 53.7%
Overall System Size = 91.64' x 32.50' x 2.33'

108 Chambers
257.4 cy Field
198.4 cy Stone



Summary for Pond C9: Banked Parking chambers

Inflow Area = 0.164 ac, 80.13% Impervious, Inflow Depth = 4.08" for 10-Year event
Inflow = 0.72 cfs @ 12.09 hrs, Volume= 0.056 af
Outflow = 0.04 cfs @ 10.60 hrs, Volume= 0.056 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.04 cfs @ 10.60 hrs, Volume= 0.056 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 187.77' @ 14.21 hrs Surf.Area= 1,561 sf Storage= 1,140 cf

Plug-Flow detention time= 269.0 min calculated for 0.056 af (100% of inflow)
Center-of-Mass det. time= 268.9 min (1,043.7 - 774.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	186.50'	1,162 cf	**20.17'W x 77.40'L x 2.33'H Field A** 3,642 cf Overall - 737 cf Embedded = 2,905 cf x 40.0% Voids
#2A	187.00'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 5 Rows
		1,899 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	186.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.50'	**8.0" Round Culvert X 2.00** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.50' / 187.90' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.04 cfs @ 10.60 hrs HW=186.53' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=186.50' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond C9: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

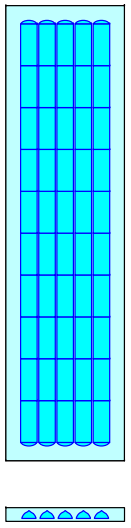
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
5 Rows x 34.0" Wide + 3.0" Spacing x 4 + 30.0" Side Stone x 2 = 20.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,642.1 cf Field - 737.1 cf Chambers = 2,905.0 cf Stone x 40.0% Voids = 1,162.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,899.1 cf = 0.044 af
Overall Storage Efficiency = 52.1%
Overall System Size = 77.40' x 20.17' x 2.33'

50 Chambers
134.9 cy Field
107.6 cy Stone



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 1.978 ac, 72.77% Impervious, Inflow Depth = 3.97" for 10-Year event
Inflow = 7.07 cfs @ 12.16 hrs, Volume= 0.655 af
Primary = 7.07 cfs @ 12.16 hrs, Volume= 0.655 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

Inflow Area = 10.265 ac, 66.83% Impervious, Inflow Depth = 3.35" for 10-Year event
Inflow = 28.97 cfs @ 12.14 hrs, Volume= 2.864 af
Primary = 28.97 cfs @ 12.14 hrs, Volume= 2.864 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

Inflow Area = 1.261 ac, 5.94% Impervious, Inflow Depth = 2.60" for 10-Year event
Inflow = 1.85 cfs @ 12.58 hrs, Volume= 0.274 af
Primary = 1.85 cfs @ 12.58 hrs, Volume= 0.274 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 14L: Outflow of Combined INF Systems

Inflow Area = 1.022 ac, 91.53% Impervious, Inflow Depth = 1.10" for 10-Year event
Inflow = 2.03 cfs @ 12.24 hrs, Volume= 0.094 af
Primary = 2.03 cfs @ 12.24 hrs, Volume= 0.094 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R-4 : new 24"

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Subcatchment P-1: Subcat P-1

Runoff = 2.63 cfs @ 12.57 hrs, Volume= 0.390 af, Depth= 3.71"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
5,634	80	>75% Grass cover, Good, HSG D
139	98	Paved parking, HSG D
3,124	98	Roofs, HSG D
46,042	77	Woods, Good, HSG D
54,939	79	Weighted Average
51,676		94.06% Pervious Area
3,263		5.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 4.78 cfs @ 12.18 hrs, Volume= 0.431 af, Depth= 3.51"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
8,544	80	>75% Grass cover, Good, HSG D
55,791	77	Woods, Good, HSG D
64,335	77	Weighted Average
64,335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
0.8	60	0.0700	1.32		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
13.1	110	Total			

Summary for Subcatchment P-2.1: Subcat P-2.1

Runoff = 0.34 cfs @ 12.09 hrs, Volume= 0.028 af, Depth= 5.56"
Routed to Reach 2R-1 : new 12" west

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
331	80	>75% Grass cover, Good, HSG D
2,258	98	Paved parking, HSG D
2,588	96	Weighted Average
331		12.77% Pervious Area
2,258		87.23% Impervious Area

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

Summary for Subcatchment P-2.10: Subcat P-2.10

Runoff = 0.76 cfs @ 12.09 hrs, Volume= 0.061 af, Depth= 5.56"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
589	80	>75% Grass cover, Good, HSG D
5,180	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
5,771	96	Weighted Average
591		10.24% Pervious Area
5,180		89.76% Impervious Area

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

Summary for Subcatchment P-2.11: Subcat P-2.11

Runoff = 1.23 cfs @ 12.09 hrs, Volume= 0.096 af, Depth= 5.21"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
2,481	80	>75% Grass cover, Good, HSG D
7,185	98	Paved parking, HSG D
9,666	93	Weighted Average
2,481		25.67% Pervious Area
7,185		74.33% Impervious Area

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

Summary for Subcatchment P-2.12: Subcat P-2.12

Runoff = 1.19 cfs @ 12.16 hrs, Volume= 0.108 af, Depth= 4.88"
Routed to Reach 1R-6 : New 24" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
5,178	80	>75% Grass cover, Good, HSG D
6,362	98	Paved parking, HSG D
11,539	90	Weighted Average
5,178		44.87% Pervious Area
6,362		55.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.5	50	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.7	150	Total			

Summary for Subcatchment P-2.2: Subcat P-2.2

Runoff = 1.78 cfs @ 12.09 hrs, Volume= 0.141 af, Depth= 5.33"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
2,863	80	>75% Grass cover, Good, HSG D
10,953	98	Paved parking, HSG D
13,816	94	Weighted Average
2,863		20.72% Pervious Area
10,953		79.28% Impervious Area

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

Summary for Subcatchment P-2.3: Subcat P-2.3

Runoff = 1.18 cfs @ 12.09 hrs, Volume= 0.093 af, Depth= 5.21"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
2,462	80	>75% Grass cover, Good, HSG D
6,825	98	Paved parking, HSG D
9,287	93	Weighted Average
2,462		26.51% Pervious Area
6,825		73.49% Impervious Area

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

Summary for Subcatchment P-2.4: Subcat P-2.4

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 0.080 af, Depth= 5.56"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
957	80	>75% Grass cover, Good, HSG D
6,529	98	Paved parking, HSG D
7,486	96	Weighted Average
957		12.79% Pervious Area
6,529		87.21% Impervious Area

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

Summary for Subcatchment P-2.5: Subcat P-2.5

Runoff = 1.82 cfs @ 12.16 hrs, Volume= 0.169 af, Depth= 5.21"
Routed to Reach 2R-5 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
5,018	80	>75% Grass cover, Good, HSG D
11,943	98	Paved parking, HSG D
16,961	93	Weighted Average
5,018		29.59% Pervious Area
11,943		70.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.4	40	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.6	70	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.8	160	Total			

Summary for Subcatchment P-2.6: Subcat P-2.6

Runoff = 1.37 cfs @ 12.09 hrs, Volume= 0.108 af, Depth= 5.33"
Routed to Reach 1R-2 : New 18" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
2,316	80	>75% Grass cover, Good, HSG D
8,330	98	Paved parking, HSG D
10,646	94	Weighted Average
2,316		21.75% Pervious Area
8,330		78.25% Impervious Area

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

Summary for Subcatchment P-2.7: Subcat P-2.7

Runoff = 0.74 cfs @ 12.09 hrs, Volume= 0.059 af, Depth= 5.33"
Routed to Pond 8P : East Rv Chambers #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
1,329	80	>75% Grass cover, Good, HSG D
4,444	98	Paved parking, HSG D
5,773	94	Weighted Average
1,329		23.03% Pervious Area
4,444		76.97% Impervious Area

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

Summary for Subcatchment P-2.8: Subcat P-2.8

Runoff = 1.73 cfs @ 12.09 hrs, Volume= 0.140 af, Depth= 5.56"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
1,303	80	>75% Grass cover, Good, HSG D
10,068	98	Paved parking, HSG D
1,828	98	Roofs, HSG D
13,200	96	Weighted Average
1,303		9.87% Pervious Area
11,897		90.13% Impervious Area

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

Summary for Subcatchment P-2.9: Subcat P-2.9

Runoff = 1.73 cfs @ 12.09 hrs, Volume= 0.140 af, Depth= 5.56"
Routed to Pond 9P : East Rv Chambers #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
1,139	80	>75% Grass cover, Good, HSG D
10,770	98	Paved parking, HSG D
1,296	98	Roofs, HSG D
13,204	96	Weighted Average
1,139		8.62% Pervious Area
12,066		91.38% Impervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 4.60 cfs @ 12.09 hrs, Volume= 0.374 af, Depth= 5.56"
Routed to Reach 1R-1 : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
1,404	80	>75% Grass cover, Good, HSG D
21,361	98	Paved parking, HSG D
9,936	98	Roofs, HSG D
2,445	77	Woods, Good, HSG D
35,147	96	Weighted Average
3,849		10.95% Pervious Area
31,297		89.05% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 4.03 cfs @ 12.09 hrs, Volume= 0.327 af, Depth= 5.56"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
4,139	80	>75% Grass cover, Good, HSG D
16,618	98	Paved parking, HSG D
9,994	98	Roofs, HSG D
30,751	96	Weighted Average
4,139		13.46% Pervious Area
26,612		86.54% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 3.97 cfs @ 12.09 hrs, Volume= 0.318 af, Depth= 5.44"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
5,035	80	>75% Grass cover, Good, HSG D
25,502	98	Paved parking, HSG D
30,538	95	Weighted Average
5,035		16.49% Pervious Area
25,502		83.51% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 8.61 cfs @ 12.09 hrs, Volume= 0.663 af, Depth= 4.88"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
27,925	80	>75% Grass cover, Good, HSG D
21,097	98	Paved parking, HSG D
19,622	98	Roofs, HSG D
2,432	77	Woods, Good, HSG D
71,076	90	Weighted Average
30,357		42.71% Pervious Area
40,719		57.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.5	48	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
6.4	136	Total			

Summary for Subcatchment P-7: Subcat P-7

Runoff = 9.14 cfs @ 12.16 hrs, Volume= 0.859 af, Depth= 5.21"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
20,862	80	>75% Grass cover, Good, HSG D
42,998	98	Paved parking, HSG D
19,710	98	Roofs, HSG D
2,606	77	Woods, Good, HSG D
86,176	93	Weighted Average
23,468		27.23% Pervious Area
62,708		72.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.7	70	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	100	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
12.3	220	Total			

Summary for Subcatchment R-1: Subcat R-1

Runoff = 1.91 cfs @ 12.00 hrs, Volume= 0.137 af, Depth= 5.79"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
12,335	98	Roofs, HSG D
12,335		100.00% Impervious Area

Summary for Subcatchment R-2: Subcat R-2

Runoff = 2.44 cfs @ 12.00 hrs, Volume= 0.174 af, Depth= 5.79"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
15,710	98	Roofs, HSG D
15,710		100.00% Impervious Area

Summary for Subcatchment R-3: Subcat R-3

Runoff = 5.09 cfs @ 12.00 hrs, Volume= 0.344 af, Depth= 5.33"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
5,750	98	Paved parking, HSG D
20,030	98	Roofs, HSG D
33,729	94	Weighted Average
7,950		23.57% Pervious Area
25,779		76.43% Impervious Area

Summary for Subcatchment R-4: Subcat R-4

Runoff = 0.80 cfs @ 12.00 hrs, Volume= 0.057 af, Depth= 5.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
5,126	98	Roofs, HSG D
5,126		100.00% Impervious Area

Summary for Subcatchment R-5: Subcat R-5

Runoff = 1.27 cfs @ 12.00 hrs, Volume= 0.090 af, Depth= 5.79"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
8,150	98	Roofs, HSG D
8,150		100.00% Impervious Area

Summary for Subcatchment R-6: Subcat R-6

Runoff = 0.74 cfs @ 12.00 hrs, Volume= 0.053 af, Depth= 5.79"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
4,793	98	Roofs, HSG D
4,793		100.00% Impervious Area

Summary for Subcatchment S-1: Subcat S-1

Runoff = 0.92 cfs @ 12.09 hrs, Volume= 0.073 af, Depth= 5.33"
Routed to Pond C9 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
1,304	80	>75% Grass cover, Good, HSG D
5,728	98	Paved parking, HSG D
117	77	Woods, Good, HSG D
7,148	94	Weighted Average
1,420		19.87% Pervious Area
5,728		80.13% Impervious Area

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

Summary for Subcatchment S-2: Subcat S-2

Runoff = 1.67 cfs @ 12.09 hrs, Volume= 0.129 af, Depth= 4.99"
Routed to Pond C8 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=6.03"

Area (sf)	CN	Description
5,013	80	>75% Grass cover, Good, HSG D
8,205	98	Paved parking, HSG D
259	77	Woods, Good, HSG D
13,478	91	Weighted Average
5,272		39.12% Pervious Area
8,205		60.88% Impervious Area

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

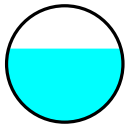
Summary for Reach 1R-1: Ex. 18" RCP

Inflow Area = 0.807 ac, 89.05% Impervious, Inflow Depth = 5.56" for 25-Year event
Inflow = 4.60 cfs @ 12.09 hrs, Volume= 0.374 af
Outflow = 4.51 cfs @ 12.10 hrs, Volume= 0.374 af, Atten= 2%, Lag= 0.9 min
Routed to Reach 1R-2 : New 18" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.92 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.34 fps, Avg. Travel Time= 1.5 min

Peak Storage= 141 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.95' , Surface Width= 1.45'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.36 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 120.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 187.72'



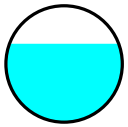
Summary for Reach 1R-2: New 18" ADS

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 5.50" for 25-Year event
Inflow = 5.87 cfs @ 12.10 hrs, Volume= 0.482 af
Outflow = 5.75 cfs @ 12.11 hrs, Volume= 0.482 af, Atten= 2%, Lag= 0.7 min
Routed to Reach 1R-3 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.63 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.60 fps, Avg. Travel Time= 1.2 min

Peak Storage= 147 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.01' , Surface Width= 1.41'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 7.38 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 116.0' Slope= 0.0035 '/'
Inlet Invert= 187.70', Outlet Invert= 187.29'



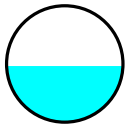
Summary for Reach 1R-3: new 24"

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 5.50" for 25-Year event
Inflow = 5.75 cfs @ 12.11 hrs, Volume= 0.482 af
Outflow = 5.46 cfs @ 12.15 hrs, Volume= 0.482 af, Atten= 5%, Lag= 2.7 min
Routed to Reach 1R-4 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.73 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 4.3 min

Peak Storage= 471 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.96' , Surface Width= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 315.0' Slope= 0.0020 '/'
Inlet Invert= 187.20', Outlet Invert= 186.57'



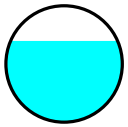
Summary for Reach 1R-4: new 24"

Inflow Area = 2.073 ac, 89.00% Impervious, Inflow Depth = 3.77" for 25-Year event
Inflow = 10.18 cfs @ 12.10 hrs, Volume= 0.652 af
Outflow = 9.40 cfs @ 12.12 hrs, Volume= 0.652 af, Atten= 8%, Lag= 1.1 min
Routed to Reach 1R-5 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.25 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 2.1 min

Peak Storage= 375 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.40' , Surface Width= 1.84'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 160.0' Slope= 0.0020 '/'
Inlet Invert= 186.50', Outlet Invert= 186.18'



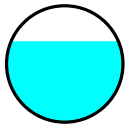
Summary for Reach 1R-5: new 24"

Inflow Area = 2.428 ac, 87.70% Impervious, Inflow Depth = 4.00" for 25-Year event
Inflow = 11.27 cfs @ 12.12 hrs, Volume= 0.809 af
Outflow = 10.68 cfs @ 12.14 hrs, Volume= 0.809 af, Atten= 5%, Lag= 1.1 min
Routed to Reach 1R-6 : New 24" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.75 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 1.1 min

Peak Storage= 222 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.39' , Surface Width= 1.84'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.44 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 95.0' Slope= 0.0025 '/'
Inlet Invert= 186.08', Outlet Invert= 185.84'



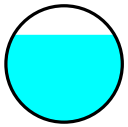
Summary for Reach 1R-6: New 24" ADS

Inflow Area = 2.692 ac, 84.49% Impervious, Inflow Depth = 4.09" for 25-Year event
Inflow = 11.86 cfs @ 12.14 hrs, Volume= 0.917 af
Outflow = 11.88 cfs @ 12.15 hrs, Volume= 0.917 af, Atten= 0%, Lag= 0.5 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.72 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.51 fps, Avg. Travel Time= 0.6 min

Peak Storage= 126 cf @ 12.14 hrs
Average Depth at Peak Storage= 1.50' , Surface Width= 1.73'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.10 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 50.0' Slope= 0.0024 '/'
Inlet Invert= 185.70', Outlet Invert= 185.58'



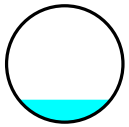
Summary for Reach 2R-1: new 12" west

Inflow Area = 0.059 ac, 87.23% Impervious, Inflow Depth = 5.56" for 25-Year event
Inflow = 0.34 cfs @ 12.09 hrs, Volume= 0.028 af
Outflow = 0.33 cfs @ 12.11 hrs, Volume= 0.028 af, Atten= 3%, Lag= 1.3 min
Routed to Reach 2R-2 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.22 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.05 fps, Avg. Travel Time= 2.4 min

Peak Storage= 16 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.19' , Surface Width= 0.79'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0100 '/'
Inlet Invert= 189.80', Outlet Invert= 188.30'



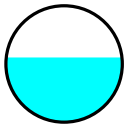
Summary for Reach 2R-2: new 12"

Inflow Area = 0.487 ac, 84.93% Impervious, Inflow Depth = 5.46" for 25-Year event
Inflow = 2.51 cfs @ 12.07 hrs, Volume= 0.221 af
Outflow = 2.49 cfs @ 12.08 hrs, Volume= 0.221 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 2R-3 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.57 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.90 fps, Avg. Travel Time= 0.7 min

Peak Storage= 34 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.56' , Surface Width= 0.99'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 75.0' Slope= 0.0100 '/'
Inlet Invert= 188.10', Outlet Invert= 187.35'



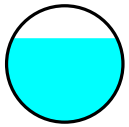
Summary for Reach 2R-3: new 12"

Inflow Area = 0.887 ac, 85.36% Impervious, Inflow Depth = 5.47" for 25-Year event
Inflow = 4.48 cfs @ 12.06 hrs, Volume= 0.404 af
Outflow = 4.46 cfs @ 12.06 hrs, Volume= 0.404 af, Atten= 0%, Lag= 0.3 min
Routed to Reach 2R-4 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.39 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.62 fps, Avg. Travel Time= 0.5 min

Peak Storage= 48 cf @ 12.06 hrs
Average Depth at Peak Storage= 0.72' , Surface Width= 0.90'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.16 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 80.0' Slope= 0.0150 '/'
Inlet Invert= 187.25', Outlet Invert= 186.05'



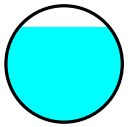
Summary for Reach 2R-4: new 18"

Inflow Area = 1.833 ac, 81.76% Impervious, Inflow Depth = 5.42" for 25-Year event
Inflow = 9.82 cfs @ 12.02 hrs, Volume= 0.828 af
Outflow = 9.51 cfs @ 12.04 hrs, Volume= 0.828 af, Atten= 3%, Lag= 1.1 min
Routed to Reach 2R-5 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.20 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.20 fps, Avg. Travel Time= 1.1 min

Peak Storage= 232 cf @ 12.03 hrs
Average Depth at Peak Storage= 1.23' , Surface Width= 1.16'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 9.62 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0060 '/'
Inlet Invert= 186.80', Outlet Invert= 185.90'



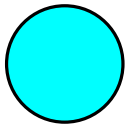
Summary for Reach 2R-5: new 18"

Inflow Area = 2.222 ac, 79.77% Impervious, Inflow Depth = 5.38" for 25-Year event
Inflow = 10.67 cfs @ 12.04 hrs, Volume= 0.997 af
Outflow = 8.78 cfs @ 12.05 hrs, Volume= 0.997 af, Atten= 18%, Lag= 0.3 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.63 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.16 fps, Avg. Travel Time= 0.5 min

Peak Storage= 106 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 8.78 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 60.0' Slope= 0.0050 '/'
Inlet Invert= 185.90', Outlet Invert= 185.60'



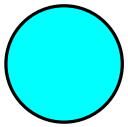
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 5.56" for 25-Year event
Inflow = 4.03 cfs @ 12.09 hrs, Volume= 0.327 af
Outflow = 3.70 cfs @ 12.09 hrs, Volume= 0.327 af, Atten= 8%, Lag= 0.5 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.37 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.00 fps, Avg. Travel Time= 0.5 min

Peak Storage= 50 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



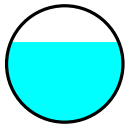
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 5.56" for 25-Year event
Inflow = 3.70 cfs @ 12.09 hrs, Volume= 0.327 af
Outflow = 3.72 cfs @ 12.10 hrs, Volume= 0.327 af, Atten= 0%, Lag= 0.5 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.15 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.48 fps, Avg. Travel Time= 0.5 min

Peak Storage= 40 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.86' , Surface Width= 1.16'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



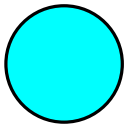
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 5.16" for 25-Year event
Inflow = 16.28 cfs @ 12.09 hrs, Volume= 1.308 af
Outflow = 14.27 cfs @ 12.18 hrs, Volume= 1.308 af, Atten= 12%, Lag= 5.3 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.83 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.79 fps, Avg. Travel Time= 1.4 min

Peak Storage= 488 cf @ 12.13 hrs
Average Depth at Peak Storage= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



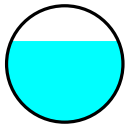
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 5.16" for 25-Year event
Inflow = 14.27 cfs @ 12.18 hrs, Volume= 1.308 af
Outflow = 13.73 cfs @ 12.20 hrs, Volume= 1.308 af, Atten= 4%, Lag= 1.2 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.93 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.08 fps, Avg. Travel Time= 1.7 min

Peak Storage= 505 cf @ 12.20 hrs
Average Depth at Peak Storage= 1.39' , Surface Width= 1.84'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Pond 5P: East Rv Chambers #2

Inflow Area = 0.586 ac, 94.90% Impervious, Inflow Depth = 5.67" for 25-Year event
Inflow = 3.10 cfs @ 12.03 hrs, Volume= 0.277 af
Outflow = 3.70 cfs @ 12.09 hrs, Volume= 0.277 af, Atten= 0%, Lag= 4.1 min
Discarded = 0.07 cfs @ 7.65 hrs, Volume= 0.172 af
Primary = 3.62 cfs @ 12.09 hrs, Volume= 0.105 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 190.83' @ 12.10 hrs Surf.Area= 3,025 sf Storage= 3,673 cf

Plug-Flow detention time= 260.4 min calculated for 0.277 af (100% of inflow)
Center-of-Mass det. time= 260.4 min (1,009.3 - 748.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	2,257 cf	**17.08'W x 177.08'L x 2.33'H Field A** 7,059 cf Overall - 1,415 cf Embedded = 5,643 cf x 40.0% Voids
#2A	187.50'	1,415 cf	**ADS_StormTech SC-310 +Cap** x 96 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 96 Chambers in 4 Rows
		3,673 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.07 cfs @ 7.65 hrs HW=187.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=3.47 cfs @ 12.09 hrs HW=190.72' (Free Discharge)
↑**2=RCP_Round 12"** (Inlet Controls 3.47 cfs @ 4.41 fps)

Pond 5P: East Rv Chambers #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

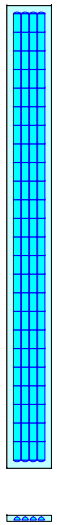
24 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 172.08' Row Length +30.0" End Stone x 2 = 177.08' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

96 Chambers x 14.7 cf = 1,415.2 cf Chamber Storage

7,058.6 cf Field - 1,415.2 cf Chambers = 5,643.4 cf Stone x 40.0% Voids = 2,257.4 cf Stone Storage

Chamber Storage + Stone Storage = 3,672.6 cf = 0.084 af
Overall Storage Efficiency = 52.0%
Overall System Size = 177.08' x 17.08' x 2.33'

96 Chambers
261.4 cy Field
209.0 cy Stone



Summary for Pond 8P: East Rv Chambers #1

Inflow Area = 0.133 ac, 76.97% Impervious, Inflow Depth = 5.33" for 25-Year event
Inflow = 0.74 cfs @ 12.09 hrs, Volume= 0.059 af
Outflow = 0.04 cfs @ 10.45 hrs, Volume= 0.059 af, Atten= 95%, Lag= 0.0 min
Discarded = 0.04 cfs @ 10.45 hrs, Volume= 0.059 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 188.36' @ 14.31 hrs Surf.Area= 1,566 sf Storage= 1,209 cf

Plug-Flow detention time= 281.8 min calculated for 0.059 af (100% of inflow)
Center-of-Mass det. time= 281.7 min (1,050.1 - 768.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,178 cf	**17.08'W x 91.64'L x 2.33'H Field A** 3,653 cf Overall - 708 cf Embedded = 2,945 cf x 40.0% Voids
#2A	187.50'	708 cf	**ADS_StormTech SC-310 +Cap** x 48 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 48 Chambers in 4 Rows
		1,886 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.04 cfs @ 10.45 hrs HW=187.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
↑**2=RCP_Round 12"** (Controls 0.00 cfs)

Pond 8P: East Rv Chambers #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

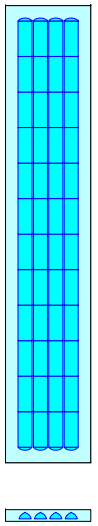
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

48 Chambers x 14.7 cf = 707.6 cf Chamber Storage

3,652.9 cf Field - 707.6 cf Chambers = 2,945.3 cf Stone x 40.0% Voids = 1,178.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,885.7 cf = 0.043 af
Overall Storage Efficiency = 51.6%
Overall System Size = 91.64' x 17.08' x 2.33'

48 Chambers
135.3 cy Field
109.1 cy Stone



Summary for Pond 9P: East Rv Chambers #3

Inflow Area = 0.303 ac, 91.38% Impervious, Inflow Depth = 5.56" for 25-Year event
Inflow = 1.73 cfs @ 12.09 hrs, Volume= 0.140 af
Outflow = 1.80 cfs @ 12.09 hrs, Volume= 0.140 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.03 cfs @ 7.40 hrs, Volume= 0.076 af
Primary = 1.76 cfs @ 12.09 hrs, Volume= 0.064 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 189.82' @ 12.09 hrs Surf.Area= 1,322 sf Storage= 1,588 cf

Plug-Flow detention time= 231.8 min calculated for 0.140 af (100% of inflow)
Center-of-Mass det. time= 231.8 min (989.9 - 758.1)

Volume	Invert	Avail.Storage	Storage Description
#1B	187.00'	998 cf	**17.08'W x 77.40'L x 2.33'H Field B** 3,085 cf Overall - 590 cf Embedded = 2,496 cf x 40.0% Voids
#2B	187.50'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows
		1,588 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.03 cfs @ 7.40 hrs HW=187.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.71 cfs @ 12.09 hrs HW=189.80' (Free Discharge)
└**2=RCP_Round 12"** (Barrel Controls 1.71 cfs @ 2.78 fps)

Pond 9P: East Rv Chambers #3 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

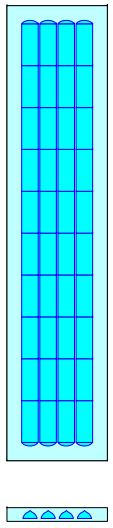
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

3,085.2 cf Field - 589.7 cf Chambers = 2,495.6 cf Stone x 40.0% Voids = 998.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,587.9 cf = 0.036 af
Overall Storage Efficiency = 51.5%
Overall System Size = 77.40' x 17.08' x 2.33'

40 Chambers
114.3 cy Field
92.4 cy Stone



Summary for Pond C8: Banked Parking chambers

Inflow Area = 0.309 ac, 60.88% Impervious, Inflow Depth = 4.99" for 25-Year event
Inflow = 1.67 cfs @ 12.09 hrs, Volume= 0.129 af
Outflow = 0.07 cfs @ 10.30 hrs, Volume= 0.129 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.07 cfs @ 10.30 hrs, Volume= 0.129 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 190.64' @ 15.01 hrs Surf.Area= 2,978 sf Storage= 2,887 cf

Plug-Flow detention time= 369.3 min calculated for 0.128 af (100% of inflow)
Center-of-Mass det. time= 369.3 min (1,150.2 - 780.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	189.00'	2,143 cf	**32.50'W x 91.64'L x 2.33'H Field A** 6,949 cf Overall - 1,592 cf Embedded = 5,357 cf x 40.0% Voids
#2A	189.50'	1,592 cf	**ADS_StormTech SC-310 +Cap** x 108 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 108 Chambers in 9 Rows
		3,735 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	189.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	191.00'	**8.0" Round Culvert X 2.00** L= 48.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.00' / 190.04' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 10.30 hrs HW=189.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=189.00' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Pond C8: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

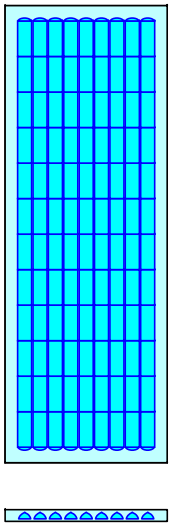
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
9 Rows x 34.0" Wide + 3.0" Spacing x 8 + 30.0" Side Stone x 2 = 32.50' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

108 Chambers x 14.7 cf = 1,592.1 cf Chamber Storage

6,949.4 cf Field - 1,592.1 cf Chambers = 5,357.2 cf Stone x 40.0% Voids = 2,142.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,735.0 cf = 0.086 af
Overall Storage Efficiency = 53.7%
Overall System Size = 91.64' x 32.50' x 2.33'

108 Chambers
257.4 cy Field
198.4 cy Stone



Summary for Pond C9: Banked Parking chambers

Inflow Area = 0.164 ac, 80.13% Impervious, Inflow Depth = 5.33" for 25-Year event
Inflow = 0.92 cfs @ 12.09 hrs, Volume= 0.073 af
Outflow = 0.04 cfs @ 9.85 hrs, Volume= 0.073 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.04 cfs @ 9.85 hrs, Volume= 0.073 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 188.42' @ 15.10 hrs Surf.Area= 1,561 sf Storage= 1,641 cf

Plug-Flow detention time= 391.1 min calculated for 0.073 af (100% of inflow)
Center-of-Mass det. time= 391.1 min (1,159.5 - 768.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	186.50'	1,162 cf	**20.17'W x 77.40'L x 2.33'H Field A** 3,642 cf Overall - 737 cf Embedded = 2,905 cf x 40.0% Voids
#2A	187.00'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 5 Rows
		1,899 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	186.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.50'	**8.0" Round Culvert X 2.00** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.50' / 187.90' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.04 cfs @ 9.85 hrs HW=186.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=186.50' (Free Discharge)
└**2=Culvert** (Controls 0.00 cfs)

Pond C9: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

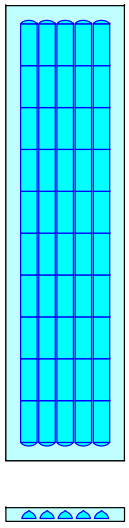
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
5 Rows x 34.0" Wide + 3.0" Spacing x 4 + 30.0" Side Stone x 2 = 20.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,642.1 cf Field - 737.1 cf Chambers = 2,905.0 cf Stone x 40.0% Voids = 1,162.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,899.1 cf = 0.044 af
Overall Storage Efficiency = 52.1%
Overall System Size = 77.40' x 20.17' x 2.33'

50 Chambers
134.9 cy Field
107.6 cy Stone



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 1.978 ac, 72.77% Impervious, Inflow Depth = 5.21" for 25-Year event
Inflow = 9.14 cfs @ 12.16 hrs, Volume= 0.859 af
Primary = 9.14 cfs @ 12.16 hrs, Volume= 0.859 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

Inflow Area = 10.265 ac, 66.83% Impervious, Inflow Depth = 4.47" for 25-Year event
Inflow = 39.63 cfs @ 12.15 hrs, Volume= 3.827 af
Primary = 39.63 cfs @ 12.15 hrs, Volume= 3.827 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

Inflow Area = 1.261 ac, 5.94% Impervious, Inflow Depth = 3.71" for 25-Year event
Inflow = 2.63 cfs @ 12.57 hrs, Volume= 0.390 af
Primary = 2.63 cfs @ 12.57 hrs, Volume= 0.390 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 14L: Outflow of Combined INF Systems

Inflow Area = 1.022 ac, 91.53% Impervious, Inflow Depth = 1.99" for 25-Year event
Inflow = 5.39 cfs @ 12.09 hrs, Volume= 0.169 af
Primary = 5.39 cfs @ 12.09 hrs, Volume= 0.169 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R-4 : new 24"

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Subcatchment P-1: Subcat P-1

Runoff = 4.28 cfs @ 12.56 hrs, Volume= 0.640 af, Depth= 6.09"
Routed to Link 3L : Northeast area at 2 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
5,634	80	>75% Grass cover, Good, HSG D
139	98	Paved parking, HSG D
3,124	98	Roofs, HSG D
46,042	77	Woods, Good, HSG D
54,939	79	Weighted Average
51,676		94.06% Pervious Area
3,263		5.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.9	50	0.0060	0.04		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
22.0	590	0.0080	0.45		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
41.9	640	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 7.91 cfs @ 12.18 hrs, Volume= 0.720 af, Depth= 5.85"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
8,544	80	>75% Grass cover, Good, HSG D
55,791	77	Woods, Good, HSG D
64,335	77	Weighted Average
64,335		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07		**Sheet Flow, AB** Woods: Light underbrush n= 0.400 P2= 3.21"
0.8	60	0.0700	1.32		**Shallow Concentrated Flow, BC** Woodland Kv= 5.0 fps
13.1	110	Total			

Summary for Subcatchment P-2.1: Subcat P-2.1

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 0.040 af, Depth= 8.14"
Routed to Reach 2R-1 : new 12" west

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
331	80	>75% Grass cover, Good, HSG D
2,258	98	Paved parking, HSG D
2,588	96	Weighted Average
331		12.77% Pervious Area
2,258		87.23% Impervious Area

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

Summary for Subcatchment P-2.10: Subcat P-2.10

Runoff = 1.09 cfs @ 12.09 hrs, Volume= 0.090 af, Depth= 8.14"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
589	80	>75% Grass cover, Good, HSG D
5,180	98	Paved parking, HSG D
2	77	Woods, Good, HSG D
5,771	96	Weighted Average
591		10.24% Pervious Area
5,180		89.76% Impervious Area

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

Summary for Subcatchment P-2.11: Subcat P-2.11

Runoff = 1.79 cfs @ 12.09 hrs, Volume= 0.144 af, Depth= 7.78"
Routed to Reach 1R-5 : new 24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
2,481	80	>75% Grass cover, Good, HSG D
7,185	98	Paved parking, HSG D
9,666	93	Weighted Average
2,481		25.67% Pervious Area
7,185		74.33% Impervious Area

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

Summary for Subcatchment P-2.12: Subcat P-2.12

Runoff = 1.77 cfs @ 12.16 hrs, Volume= 0.164 af, Depth= 7.42"
Routed to Reach 1R-6 : New 24" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
5,178	80	>75% Grass cover, Good, HSG D
6,362	98	Paved parking, HSG D
11,539	90	Weighted Average
5,178		44.87% Pervious Area
6,362		55.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.5	50	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.7	150	Total			

Summary for Subcatchment P-2.2: Subcat P-2.2

Runoff = 2.58 cfs @ 12.09 hrs, Volume= 0.209 af, Depth= 7.90"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
2,863	80	>75% Grass cover, Good, HSG D
10,953	98	Paved parking, HSG D
13,816	94	Weighted Average
2,863		20.72% Pervious Area
10,953		79.28% Impervious Area

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

Summary for Subcatchment P-2.3: Subcat P-2.3

Runoff = 1.72 cfs @ 12.09 hrs, Volume= 0.138 af, Depth= 7.78"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
2,462	80	>75% Grass cover, Good, HSG D
6,825	98	Paved parking, HSG D
9,287	93	Weighted Average
2,462		26.51% Pervious Area
6,825		73.49% Impervious Area

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

Summary for Subcatchment P-2.4: Subcat P-2.4

Runoff = 1.41 cfs @ 12.09 hrs, Volume= 0.117 af, Depth= 8.14"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
957	80	>75% Grass cover, Good, HSG D
6,529	98	Paved parking, HSG D
7,486	96	Weighted Average
957		12.79% Pervious Area
6,529		87.21% Impervious Area

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

Summary for Subcatchment P-2.5: Subcat P-2.5

Runoff = 2.66 cfs @ 12.16 hrs, Volume= 0.252 af, Depth= 7.78"
Routed to Reach 2R-5 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
5,018	80	>75% Grass cover, Good, HSG D
11,943	98	Paved parking, HSG D
16,961	93	Weighted Average
5,018		29.59% Pervious Area
11,943		70.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.4	40	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.6	70	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
11.8	160	Total			

Summary for Subcatchment P-2.6: Subcat P-2.6

Runoff = 1.99 cfs @ 12.09 hrs, Volume= 0.161 af, Depth= 7.90"
Routed to Reach 1R-2 : New 18" ADS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
2,316	80	>75% Grass cover, Good, HSG D
8,330	98	Paved parking, HSG D
10,646	94	Weighted Average
2,316		21.75% Pervious Area
8,330		78.25% Impervious Area

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

Summary for Subcatchment P-2.7: Subcat P-2.7

Runoff = 1.08 cfs @ 12.09 hrs, Volume= 0.087 af, Depth= 7.90"
Routed to Pond 8P : East Rv Chambers #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
1,329	80	>75% Grass cover, Good, HSG D
4,444	98	Paved parking, HSG D
5,773	94	Weighted Average
1,329		23.03% Pervious Area
4,444		76.97% Impervious Area

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

Summary for Subcatchment P-2.8: Subcat P-2.8

Runoff = 2.49 cfs @ 12.09 hrs, Volume= 0.206 af, Depth= 8.14"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
1,303	80	>75% Grass cover, Good, HSG D
10,068	98	Paved parking, HSG D
1,828	98	Roofs, HSG D
13,200	96	Weighted Average
1,303		9.87% Pervious Area
11,897		90.13% Impervious Area

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

Summary for Subcatchment P-2.9: Subcat P-2.9

Runoff = 2.49 cfs @ 12.09 hrs, Volume= 0.206 af, Depth= 8.14"
Routed to Pond 9P : East Rv Chambers #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
1,139	80	>75% Grass cover, Good, HSG D
10,770	98	Paved parking, HSG D
1,296	98	Roofs, HSG D
13,204	96	Weighted Average
1,139		8.62% Pervious Area
12,066		91.38% Impervious Area

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 6.63 cfs @ 12.09 hrs, Volume= 0.547 af, Depth= 8.14"
Routed to Reach 1R-1 : Ex. 18" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
1,404	80	>75% Grass cover, Good, HSG D
21,361	98	Paved parking, HSG D
9,936	98	Roofs, HSG D
2,445	77	Woods, Good, HSG D
35,147	96	Weighted Average
3,849		10.95% Pervious Area
31,297		89.05% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 5.80 cfs @ 12.09 hrs, Volume= 0.479 af, Depth= 8.14"
Routed to Reach 3R : Ex. 12" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
4,139	80	>75% Grass cover, Good, HSG D
16,618	98	Paved parking, HSG D
9,994	98	Roofs, HSG D
30,751	96	Weighted Average
4,139		13.46% Pervious Area
26,612		86.54% Impervious Area

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

Summary for Subcatchment P-5: Subcat P-5

Runoff = 5.73 cfs @ 12.09 hrs, Volume= 0.468 af, Depth= 8.02"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
5,035	80	>75% Grass cover, Good, HSG D
25,502	98	Paved parking, HSG D
30,538	95	Weighted Average
5,035		16.49% Pervious Area
25,502		83.51% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 12.78 cfs @ 12.09 hrs, Volume= 1.008 af, Depth= 7.42"
Routed to Reach 7R : Ex. 24" RCP

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
27,925	80	>75% Grass cover, Good, HSG D
21,097	98	Paved parking, HSG D
19,622	98	Roofs, HSG D
2,432	77	Woods, Good, HSG D
71,076	90	Weighted Average
30,357		42.71% Pervious Area
40,719		57.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	50	0.0200	0.15		**Sheet Flow, AB** Grass: Short n= 0.150 P2= 3.21"
0.5	48	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.3	38	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
6.4	136	Total			

Summary for Subcatchment P-7: Subcat P-7

Runoff = 13.35 cfs @ 12.16 hrs, Volume= 1.282 af, Depth= 7.78"
Routed to Link 1L : Ex. CB w/15" RCP to 3 Federal

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
20,862	80	>75% Grass cover, Good, HSG D
42,998	98	Paved parking, HSG D
19,710	98	Roofs, HSG D
2,606	77	Woods, Good, HSG D
86,176	93	Weighted Average
23,468		27.23% Pervious Area
62,708		72.77% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.8	50	0.0100	0.08		**Sheet Flow, AB** Grass: Dense n= 0.240 P2= 3.21"
0.7	70	0.0100	1.61		**Shallow Concentrated Flow, BC** Unpaved Kv= 16.1 fps
0.8	100	0.0100	2.03		**Shallow Concentrated Flow, CD** Paved Kv= 20.3 fps
12.3	220	Total			

Summary for Subcatchment R-1: Subcat R-1

Runoff = 2.74 cfs @ 12.00 hrs, Volume= 0.198 af, Depth= 8.38"
Routed to Pond 5P : East Rv Chambers #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
12,335	98	Roofs, HSG D
12,335		100.00% Impervious Area

Summary for Subcatchment R-2: Subcat R-2

Runoff = 3.49 cfs @ 12.00 hrs, Volume= 0.252 af, Depth= 8.38"
Routed to Link 2L : Flow to BVW

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
15,710	98	Roofs, HSG D
15,710		100.00% Impervious Area

Summary for Subcatchment R-3: Subcat R-3

Runoff = 7.38 cfs @ 12.00 hrs, Volume= 0.510 af, Depth= 7.90"
Routed to Reach 2R-4 : new 18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
7,950	80	>75% Grass cover, Good, HSG D
5,750	98	Paved parking, HSG D
20,030	98	Roofs, HSG D
33,729	94	Weighted Average
7,950		23.57% Pervious Area
25,779		76.43% Impervious Area

Summary for Subcatchment R-4: Subcat R-4

Runoff = 1.14 cfs @ 12.00 hrs, Volume= 0.082 af, Depth= 8.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
5,126	98	Roofs, HSG D
5,126		100.00% Impervious Area

Summary for Subcatchment R-5: Subcat R-5

Runoff = 1.81 cfs @ 12.00 hrs, Volume= 0.131 af, Depth= 8.38"
Routed to Reach 2R-3 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
8,150	98	Roofs, HSG D
8,150		100.00% Impervious Area

Summary for Subcatchment R-6: Subcat R-6

Runoff = 1.07 cfs @ 12.00 hrs, Volume= 0.077 af, Depth= 8.38"
Routed to Reach 2R-2 : new 12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
4,793	98	Roofs, HSG D
4,793		100.00% Impervious Area

Summary for Subcatchment S-1: Subcat S-1

Runoff = 1.34 cfs @ 12.09 hrs, Volume= 0.108 af, Depth= 7.90"
Routed to Pond C9 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
1,304	80	>75% Grass cover, Good, HSG D
5,728	98	Paved parking, HSG D
117	77	Woods, Good, HSG D
7,148	94	Weighted Average
1,420		19.87% Pervious Area
5,728		80.13% Impervious Area

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

Summary for Subcatchment S-2: Subcat S-2

Runoff = 2.47 cfs @ 12.09 hrs, Volume= 0.194 af, Depth= 7.54"
Routed to Pond C8 : Banked Parking chambers

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.62"

Area (sf)	CN	Description
5,013	80	>75% Grass cover, Good, HSG D
8,205	98	Paved parking, HSG D
259	77	Woods, Good, HSG D
13,478	91	Weighted Average
5,272		39.12% Pervious Area
8,205		60.88% Impervious Area

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

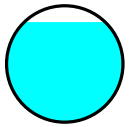
Summary for Reach 1R-1: Ex. 18" RCP

Inflow Area = 0.807 ac, 89.05% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 6.63 cfs @ 12.09 hrs, Volume= 0.547 af
Outflow = 6.48 cfs @ 12.10 hrs, Volume= 0.547 af, Atten= 2%, Lag= 0.9 min
Routed to Reach 1R-2 : New 18" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.09 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.50 fps, Avg. Travel Time= 1.3 min

Peak Storage= 194 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.29' , Surface Width= 1.04'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 6.36 cfs

18.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 120.0' Slope= 0.0037 '/'
Inlet Invert= 188.16', Outlet Invert= 187.72'



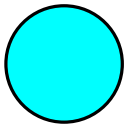
Summary for Reach 1R-2: New 18" ADS

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 8.08" for 100-Year event
Inflow = 8.45 cfs @ 12.10 hrs, Volume= 0.708 af
Outflow = 7.45 cfs @ 12.13 hrs, Volume= 0.708 af, Atten= 12%, Lag= 1.8 min
Routed to Reach 1R-3 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.76 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.78 fps, Avg. Travel Time= 1.1 min

Peak Storage= 209 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 7.38 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 116.0' Slope= 0.0035 '/'
Inlet Invert= 187.70', Outlet Invert= 187.29'



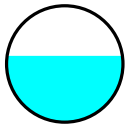
Summary for Reach 1R-3: new 24"

Inflow Area = 1.051 ac, 86.54% Impervious, Inflow Depth = 8.08" for 100-Year event
Inflow = 7.45 cfs @ 12.13 hrs, Volume= 0.708 af
Outflow = 7.36 cfs @ 12.16 hrs, Volume= 0.708 af, Atten= 1%, Lag= 2.1 min
Routed to Reach 1R-4 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.00 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.38 fps, Avg. Travel Time= 3.8 min

Peak Storage= 582 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.14' , Surface Width= 1.98'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 315.0' Slope= 0.0020 '/'
Inlet Invert= 187.20', Outlet Invert= 186.57'



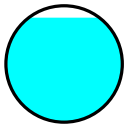
Summary for Reach 1R-4: new 24"

Inflow Area = 2.073 ac, 89.00% Impervious, Inflow Depth = 6.10" for 100-Year event
Inflow = 12.66 cfs @ 12.11 hrs, Volume= 1.054 af
Outflow = 12.63 cfs @ 12.13 hrs, Volume= 1.054 af, Atten= 0%, Lag= 1.2 min
Routed to Reach 1R-5 : new 24"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.34 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 1.8 min

Peak Storage= 476 cf @ 12.11 hrs
Average Depth at Peak Storage= 1.79' , Surface Width= 1.22'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 11.96 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 160.0' Slope= 0.0020 '/'
Inlet Invert= 186.50', Outlet Invert= 186.18'



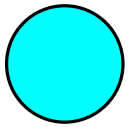
Summary for Reach 1R-5: new 24"

Inflow Area = 2.428 ac, 87.70% Impervious, Inflow Depth = 6.37" for 100-Year event
Inflow = 15.37 cfs @ 12.11 hrs, Volume= 1.288 af
Outflow = 14.40 cfs @ 12.23 hrs, Volume= 1.288 af, Atten= 6%, Lag= 7.3 min
Routed to Reach 1R-6 : New 24" ADS

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.87 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.68 fps, Avg. Travel Time= 0.9 min

Peak Storage= 298 cf @ 12.10 hrs
Average Depth at Peak Storage= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.44 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 95.0' Slope= 0.0025 '/'
Inlet Invert= 186.08', Outlet Invert= 185.84'



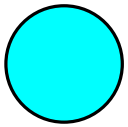
Summary for Reach 1R-6: New 24" ADS

Inflow Area = 2.692 ac, 84.49% Impervious, Inflow Depth = 6.47" for 100-Year event
Inflow = 15.53 cfs @ 12.25 hrs, Volume= 1.452 af
Outflow = 13.10 cfs @ 12.10 hrs, Volume= 1.452 af, Atten= 16%, Lag= 0.0 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.70 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 0.5 min

Peak Storage= 157 cf @ 12.05 hrs
Average Depth at Peak Storage= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.10 cfs

24.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 50.0' Slope= 0.0024 '/'
Inlet Invert= 185.70', Outlet Invert= 185.58'



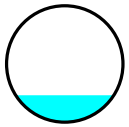
Summary for Reach 2R-1: new 12" west

Inflow Area = 0.059 ac, 87.23% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 0.49 cfs @ 12.09 hrs, Volume= 0.040 af
Outflow = 0.47 cfs @ 12.11 hrs, Volume= 0.040 af, Atten= 3%, Lag= 1.1 min
Routed to Reach 2R-2 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.58 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 2.1 min

Peak Storage= 20 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.23' , Surface Width= 0.84'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0100 '/'
Inlet Invert= 189.80', Outlet Invert= 188.30'



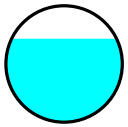
Summary for Reach 2R-2: new 12"

Inflow Area = 0.487 ac, 84.93% Impervious, Inflow Depth = 8.04" for 100-Year event
Inflow = 3.64 cfs @ 12.07 hrs, Volume= 0.326 af
Outflow = 3.61 cfs @ 12.08 hrs, Volume= 0.326 af, Atten= 1%, Lag= 0.4 min
Routed to Reach 2R-3 : new 12"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.02 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.13 fps, Avg. Travel Time= 0.6 min

Peak Storage= 45 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.72' , Surface Width= 0.90'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.21 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 75.0' Slope= 0.0100 '/'
Inlet Invert= 188.10', Outlet Invert= 187.35'



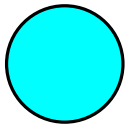
Summary for Reach 2R-3: new 12"

Inflow Area = 0.887 ac, 85.36% Impervious, Inflow Depth = 8.05" for 100-Year event
Inflow = 6.49 cfs @ 12.06 hrs, Volume= 0.595 af
Outflow = 5.16 cfs @ 12.05 hrs, Volume= 0.595 af, Atten= 21%, Lag= 0.0 min
Routed to Reach 2R-4 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.46 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.94 fps, Avg. Travel Time= 0.5 min

Peak Storage= 63 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.16 cfs

12.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 80.0' Slope= 0.0150 '/'
Inlet Invert= 187.25', Outlet Invert= 186.05'



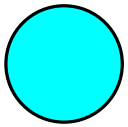
Summary for Reach 2R-4: new 18"

Inflow Area = 1.833 ac, 81.76% Impervious, Inflow Depth = 7.99" for 100-Year event
Inflow = 13.48 cfs @ 12.01 hrs, Volume= 1.221 af
Outflow = 9.64 cfs @ 12.00 hrs, Volume= 1.221 af, Atten= 28%, Lag= 0.0 min
Routed to Reach 2R-5 : new 18"

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.20 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.47 fps, Avg. Travel Time= 1.0 min

Peak Storage= 265 cf @ 12.00 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 9.62 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 150.0' Slope= 0.0060 '/'
Inlet Invert= 186.80', Outlet Invert= 185.90'



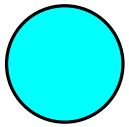
Summary for Reach 2R-5: new 18"

Inflow Area = 2.222 ac, 79.77% Impervious, Inflow Depth = 7.96" for 100-Year event
Inflow = 12.28 cfs @ 12.16 hrs, Volume= 1.473 af
Outflow = 8.78 cfs @ 12.00 hrs, Volume= 1.473 af, Atten= 29%, Lag= 0.0 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.61 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.43 fps, Avg. Travel Time= 0.4 min

Peak Storage= 106 cf @ 11.95 hrs
Average Depth at Peak Storage= 1.50'
Bank-Full Depth= 1.50' Flow Area= 1.8 sf, Capacity= 8.78 cfs

18.0" Round Pipe
n= 0.011 PVC, smooth interior
Length= 60.0' Slope= 0.0050 '/'
Inlet Invert= 185.90', Outlet Invert= 185.60'



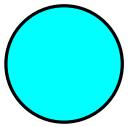
Summary for Reach 3R: Ex. 12" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 5.80 cfs @ 12.09 hrs, Volume= 0.479 af
Outflow = 4.06 cfs @ 12.33 hrs, Volume= 0.479 af, Atten= 30%, Lag= 14.6 min
Routed to Reach 4R : Ex. 15" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.37 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.22 fps, Avg. Travel Time= 0.5 min

Peak Storage= 50 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 3.70 cfs

12.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 64.0' Slope= 0.0108 '/'
Inlet Invert= 188.35', Outlet Invert= 187.66'



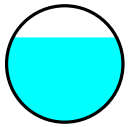
Summary for Reach 4R: Ex. 15" RCP

Inflow Area = 0.706 ac, 86.54% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 4.06 cfs @ 12.33 hrs, Volume= 0.479 af
Outflow = 4.01 cfs @ 12.33 hrs, Volume= 0.479 af, Atten= 1%, Lag= 0.0 min
Routed to Reach 7R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.18 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.66 fps, Avg. Travel Time= 0.4 min

Peak Storage= 42 cf @ 12.33 hrs
Average Depth at Peak Storage= 0.91' , Surface Width= 1.11'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 4.57 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 44.0' Slope= 0.0050 '/'
Inlet Invert= 187.66', Outlet Invert= 187.44'



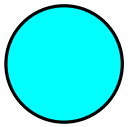
Summary for Reach 7R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 7.72" for 100-Year event
Inflow = 22.18 cfs @ 12.09 hrs, Volume= 1.956 af
Outflow = 14.01 cfs @ 12.02 hrs, Volume= 1.956 af, Atten= 37%, Lag= 0.0 min
Routed to Reach 8R : Ex. 24" RCP

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.79 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.01 fps, Avg. Travel Time= 1.3 min

Peak Storage= 484 cf @ 12.05 hrs
Average Depth at Peak Storage= 2.00'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 13.40 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 154.0' Slope= 0.0035 '/'
Inlet Invert= 186.94', Outlet Invert= 186.40'



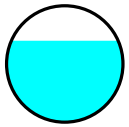
Summary for Reach 8R: Ex. 24" RCP

Inflow Area = 3.039 ac, 70.13% Impervious, Inflow Depth = 7.72" for 100-Year event
Inflow = 14.01 cfs @ 12.02 hrs, Volume= 1.956 af
Outflow = 13.79 cfs @ 12.06 hrs, Volume= 1.956 af, Atten= 2%, Lag= 2.5 min
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.93 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.35 fps, Avg. Travel Time= 1.5 min

Peak Storage= 506 cf @ 12.05 hrs
Average Depth at Peak Storage= 1.40' , Surface Width= 1.84'
Bank-Full Depth= 2.00' Flow Area= 3.1 sf, Capacity= 16.65 cfs

24.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 216.0' Slope= 0.0054 '/'
Inlet Invert= 186.30', Outlet Invert= 185.13'



Summary for Pond 5P: East Rv Chambers #2

Inflow Area = 0.586 ac, 94.90% Impervious, Inflow Depth = 8.26" for 100-Year event
Inflow = 4.45 cfs @ 12.03 hrs, Volume= 0.403 af
Outflow = 4.47 cfs @ 12.03 hrs, Volume= 0.403 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.07 cfs @ 6.20 hrs, Volume= 0.190 af
Primary = 4.40 cfs @ 12.03 hrs, Volume= 0.213 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 191.53' @ 12.03 hrs Surf.Area= 3,025 sf Storage= 3,673 cf

Plug-Flow detention time= 207.8 min calculated for 0.403 af (100% of inflow)
Center-of-Mass det. time= 207.8 min (950.8 - 743.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	2,257 cf	**17.08'W x 177.08'L x 2.33'H Field A** 7,059 cf Overall - 1,415 cf Embedded = 5,643 cf x 40.0% Voids
#2A	187.50'	1,415 cf	**ADS_StormTech SC-310 +Cap** x 96 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 96 Chambers in 4 Rows
		3,673 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.07 cfs @ 6.20 hrs HW=187.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=4.30 cfs @ 12.03 hrs HW=191.45' (Free Discharge)
↑**2=RCP_Round 12"** (Inlet Controls 4.30 cfs @ 5.48 fps)

Pond 5P: East Rv Chambers #2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

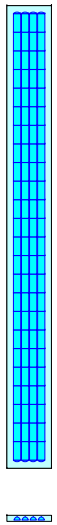
24 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 172.08' Row Length +30.0" End Stone x 2 = 177.08' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

96 Chambers x 14.7 cf = 1,415.2 cf Chamber Storage

7,058.6 cf Field - 1,415.2 cf Chambers = 5,643.4 cf Stone x 40.0% Voids = 2,257.4 cf Stone Storage

Chamber Storage + Stone Storage = 3,672.6 cf = 0.084 af
Overall Storage Efficiency = 52.0%
Overall System Size = 177.08' x 17.08' x 2.33'

96 Chambers
261.4 cy Field
209.0 cy Stone



Summary for Pond 8P: East Rv Chambers #1

Inflow Area = 0.133 ac, 76.97% Impervious, Inflow Depth = 7.90" for 100-Year event
Inflow = 1.08 cfs @ 12.09 hrs, Volume= 0.087 af
Outflow = 0.15 cfs @ 12.60 hrs, Volume= 0.087 af, Atten= 86%, Lag= 31.0 min
Discarded = 0.04 cfs @ 9.20 hrs, Volume= 0.077 af
Primary = 0.12 cfs @ 12.60 hrs, Volume= 0.011 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 189.06' @ 12.60 hrs Surf.Area= 1,566 sf Storage= 1,717 cf

Plug-Flow detention time= 342.5 min calculated for 0.087 af (100% of inflow)
Center-of-Mass det. time= 342.4 min (1,102.1 - 759.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,178 cf	**17.08'W x 91.64'L x 2.33'H Field A** 3,653 cf Overall - 708 cf Embedded = 2,945 cf x 40.0% Voids
#2A	187.50'	708 cf	**ADS_StormTech SC-310 +Cap** x 48 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 48 Chambers in 4 Rows
		1,886 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.04 cfs @ 9.20 hrs HW=187.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.12 cfs @ 12.60 hrs HW=189.06' (Free Discharge)
↑**2=RCP_Round 12"** (Barrel Controls 0.12 cfs @ 1.25 fps)

Pond 8P: East Rv Chambers #1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

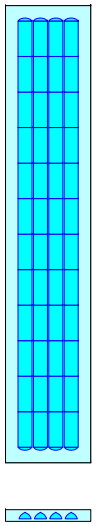
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

48 Chambers x 14.7 cf = 707.6 cf Chamber Storage

3,652.9 cf Field - 707.6 cf Chambers = 2,945.3 cf Stone x 40.0% Voids = 1,178.1 cf Stone Storage

Chamber Storage + Stone Storage = 1,885.7 cf = 0.043 af
Overall Storage Efficiency = 51.6%
Overall System Size = 91.64' x 17.08' x 2.33'

48 Chambers
135.3 cy Field
109.1 cy Stone



Summary for Pond 9P: East Rv Chambers #3

Inflow Area = 0.303 ac, 91.38% Impervious, Inflow Depth = 8.14" for 100-Year event
Inflow = 2.49 cfs @ 12.09 hrs, Volume= 0.206 af
Outflow = 2.55 cfs @ 12.07 hrs, Volume= 0.206 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.03 cfs @ 5.75 hrs, Volume= 0.084 af
Primary = 2.52 cfs @ 12.07 hrs, Volume= 0.122 af
Routed to Link 14L : Outflow of Combined INF Systems

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 190.12' @ 12.07 hrs Surf.Area= 1,322 sf Storage= 1,588 cf

Plug-Flow detention time= 182.3 min calculated for 0.206 af (100% of inflow)
Center-of-Mass det. time= 182.3 min (933.3 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1B	187.00'	998 cf	**17.08'W x 77.40'L x 2.33'H Field B** 3,085 cf Overall - 590 cf Embedded = 2,496 cf x 40.0% Voids
#2B	187.50'	590 cf	**ADS_StormTech SC-310 +Cap** x 40 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 40 Chambers in 4 Rows
		1,588 cf	Total Available Storage

Storage Group B created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.87'	**12.0" Round RCP_Round 12"** L= 7.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.83' / 188.87' S= -0.0057 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=0.03 cfs @ 5.75 hrs HW=187.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=2.39 cfs @ 12.07 hrs HW=190.07' (Free Discharge)
└**2=RCP_Round 12"** (Barrel Controls 2.39 cfs @ 3.14 fps)

Pond 9P: East Rv Chambers #3 - Chamber Wizard Field B

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

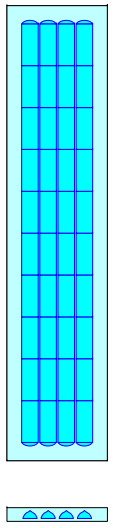
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
4 Rows x 34.0" Wide + 3.0" Spacing x 3 + 30.0" Side Stone x 2 = 17.08' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

40 Chambers x 14.7 cf = 589.7 cf Chamber Storage

3,085.2 cf Field - 589.7 cf Chambers = 2,495.6 cf Stone x 40.0% Voids = 998.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,587.9 cf = 0.036 af
Overall Storage Efficiency = 51.5%
Overall System Size = 77.40' x 17.08' x 2.33'

40 Chambers
114.3 cy Field
92.4 cy Stone



Summary for Pond C8: Banked Parking chambers

Inflow Area = 0.309 ac, 60.88% Impervious, Inflow Depth = 7.54" for 100-Year event
Inflow = 2.47 cfs @ 12.09 hrs, Volume= 0.194 af
Outflow = 0.60 cfs @ 12.47 hrs, Volume= 0.194 af, Atten= 76%, Lag= 23.2 min
Discarded = 0.07 cfs @ 9.00 hrs, Volume= 0.156 af
Primary = 0.53 cfs @ 12.47 hrs, Volume= 0.038 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 191.33' @ 12.47 hrs Surf.Area= 2,978 sf Storage= 3,729 cf

Plug-Flow detention time= 360.7 min calculated for 0.194 af (100% of inflow)
Center-of-Mass det. time= 360.7 min (1,131.2 - 770.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	189.00'	2,143 cf	**32.50'W x 91.64'L x 2.33'H Field A** 6,949 cf Overall - 1,592 cf Embedded = 5,357 cf x 40.0% Voids
#2A	189.50'	1,592 cf	**ADS_StormTech SC-310 +Cap** x 108 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 108 Chambers in 9 Rows
		3,735 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	189.00'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	191.00'	**8.0" Round Culvert X 2.00** L= 48.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 191.00' / 190.04' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.07 cfs @ 9.00 hrs HW=189.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.52 cfs @ 12.47 hrs HW=191.33' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.52 cfs @ 1.53 fps)

Pond C8: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

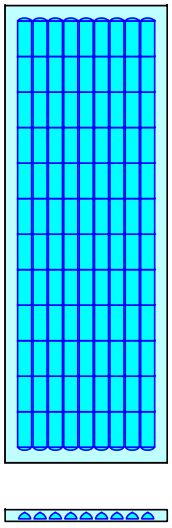
12 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 86.64' Row Length +30.0" End Stone x 2 = 91.64' Base Length
9 Rows x 34.0" Wide + 3.0" Spacing x 8 + 30.0" Side Stone x 2 = 32.50' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

108 Chambers x 14.7 cf = 1,592.1 cf Chamber Storage

6,949.4 cf Field - 1,592.1 cf Chambers = 5,357.2 cf Stone x 40.0% Voids = 2,142.9 cf Stone Storage

Chamber Storage + Stone Storage = 3,735.0 cf = 0.086 af
Overall Storage Efficiency = 53.7%
Overall System Size = 91.64' x 32.50' x 2.33'

108 Chambers
257.4 cy Field
198.4 cy Stone



Summary for Pond C9: Banked Parking chambers

Inflow Area = 0.164 ac, 80.13% Impervious, Inflow Depth = 7.90" for 100-Year event
Inflow = 1.34 cfs @ 12.09 hrs, Volume= 0.108 af
Outflow = 0.49 cfs @ 12.35 hrs, Volume= 0.108 af, Atten= 63%, Lag= 15.5 min
Discarded = 0.04 cfs @ 8.65 hrs, Volume= 0.083 af
Primary = 0.45 cfs @ 12.35 hrs, Volume= 0.025 af
Routed to Link 2L : Flow to BVW

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 188.80' @ 12.35 hrs Surf.Area= 1,561 sf Storage= 1,879 cf

Plug-Flow detention time= 325.3 min calculated for 0.108 af (100% of inflow)
Center-of-Mass det. time= 325.6 min (1,085.3 - 759.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	186.50'	1,162 cf	**20.17'W x 77.40'L x 2.33'H Field A** 3,642 cf Overall - 737 cf Embedded = 2,905 cf x 40.0% Voids
#2A	187.00'	737 cf	**ADS_StormTech SC-310 +Cap** x 50 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 50 Chambers in 5 Rows
		1,899 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	186.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	188.50'	**8.0" Round Culvert X 2.00** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 188.50' / 187.90' S= 0.0200 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.35 sf

Discarded OutFlow Max=0.04 cfs @ 8.65 hrs HW=186.53' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.45 cfs @ 12.35 hrs HW=188.80' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.45 cfs @ 1.47 fps)

Pond C9: Banked Parking chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 3.0" Spacing = 37.0" C-C Row Spacing

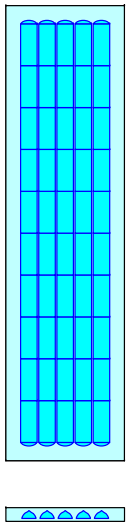
10 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 72.40' Row Length +30.0" End Stone x 2 = 77.40' Base Length
5 Rows x 34.0" Wide + 3.0" Spacing x 4 + 30.0" Side Stone x 2 = 20.17' Base Width
6.0" Stone Base + 16.0" Chamber Height + 6.0" Stone Cover = 2.33' Field Height

50 Chambers x 14.7 cf = 737.1 cf Chamber Storage

3,642.1 cf Field - 737.1 cf Chambers = 2,905.0 cf Stone x 40.0% Voids = 1,162.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,899.1 cf = 0.044 af
Overall Storage Efficiency = 52.1%
Overall System Size = 77.40' x 20.17' x 2.33'

50 Chambers
134.9 cy Field
107.6 cy Stone



Summary for Link 1L: Ex. CB w/15" RCP to 3 Federal

Inflow Area = 1.978 ac, 72.77% Impervious, Inflow Depth = 7.78" for 100-Year event
Inflow = 13.35 cfs @ 12.16 hrs, Volume= 1.282 af
Primary = 13.35 cfs @ 12.16 hrs, Volume= 1.282 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 2L: Flow to BVW

Inflow Area = 10.265 ac, 66.83% Impervious, Inflow Depth = 6.92" for 100-Year event
Inflow = 44.50 cfs @ 12.17 hrs, Volume= 5.915 af
Primary = 44.50 cfs @ 12.17 hrs, Volume= 5.915 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 3L: Northeast area at 2 Federal

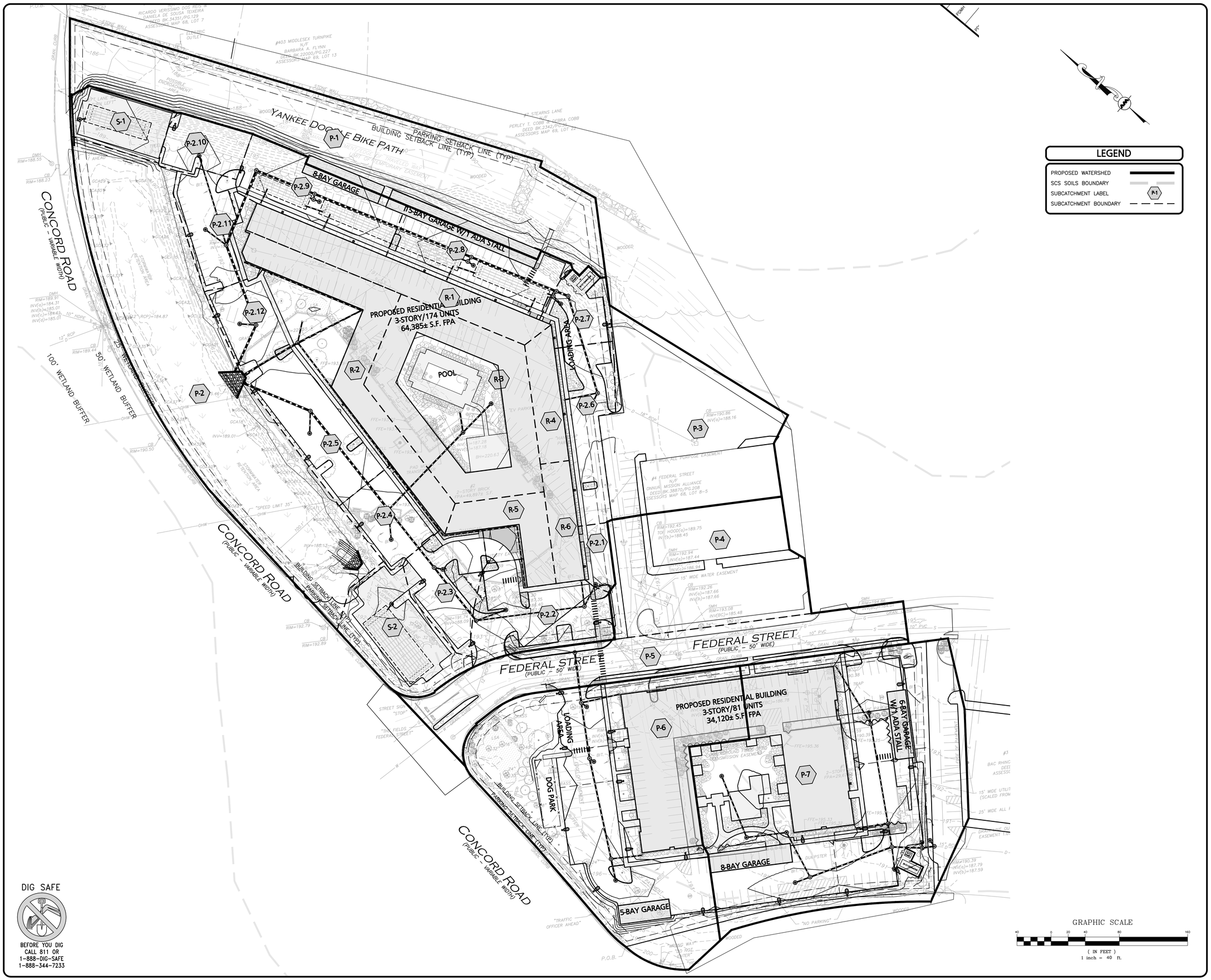
Inflow Area = 1.261 ac, 5.94% Impervious, Inflow Depth = 6.09" for 100-Year event
Inflow = 4.28 cfs @ 12.56 hrs, Volume= 0.640 af
Primary = 4.28 cfs @ 12.56 hrs, Volume= 0.640 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link 14L: Outflow of Combined INF Systems

Inflow Area = 1.022 ac, 91.53% Impervious, Inflow Depth = 4.06" for 100-Year event
Inflow = 6.78 cfs @ 12.05 hrs, Volume= 0.346 af
Primary = 6.78 cfs @ 12.05 hrs, Volume= 0.346 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R-4 : new 24"

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs



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M:\PROJECTS\3490-03\CIVIL\DRAWINGS\CURRENT\C-3490-03_WATERSHED-PROPOSED.DWG

ISSUED FOR SITE PLAN REVIEW AND NOI
NOVEMBER 3, 2025

COMMONWEALTH OF MASSACHUSETTS
PHILIP L. CORDEIRO
CIVIL
NO. 47083
REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Philip Cordeiro
Date: 2025.10.31 16:32:04-04'00'

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION

APPLICANT\OWNER:
JLB REALTY, LLC
2310 WASHINGTON STREET
NEWTON, MA 02462

PROJECT:
JLB BILLERICA
1 & 2 FEDERAL STREET
BILLERICA, MA

PROJECT NO.	3490-03	DATE:	11-03-2025
SCALE:	1" = 40'	DWG. NAME:	C3490-03
DESIGNED BY:	SF/JAP	CHECKED BY:	PLC

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
10 MAIN STREET
LAKEVILLE, MA 02347
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WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
PROPOSED WATERSHED PLAN

SHEET No.
PWS

SECTION 5.0 -
APPENDIX

Rainfall Data

PDS-based 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	**0.314** (0.249-0.392)	**0.378** (0.299-0.471)	**0.482** (0.380-0.603)	**0.569** (0.445-0.715)	**0.687** (0.520-0.900)	**0.775** (0.574-1.04)	**0.869** (0.625-1.21)	**0.977** (0.660-1.38)	**1.14** (0.737-1.65)	**1.27** (0.803-1.88)
10-min	**0.445** (0.353-0.555)	**0.535** (0.423-0.668)	**0.682** (0.538-0.853)	**0.805** (0.630-1.01)	**0.973** (0.736-1.28)	**1.10** (0.814-1.47)	**1.23** (0.885-1.71)	**1.39** (0.937-1.95)	**1.61** (1.04-2.34)	**1.80** (1.14-2.66)
15-min	**0.524** (0.415-0.653)	**0.630** (0.498-0.786)	**0.803** (0.633-1.00)	**0.946** (0.741-1.19)	**1.14** (0.866-1.50)	**1.29** (0.957-1.73)	**1.45** (1.04-2.01)	**1.63** (1.10-2.30)	**1.90** (1.23-2.76)	**2.12** (1.34-3.13)
30-min	**0.717** (0.567-0.893)	**0.863** (0.682-1.08)	**1.10** (0.867-1.38)	**1.30** (1.02-1.63)	**1.57** (1.19-2.06)	**1.78** (1.31-2.38)	**1.99** (1.43-2.76)	**2.24** (1.52-3.16)	**2.61** (1.69-3.80)	**2.92** (1.84-4.32)
60-min	**0.909** (0.720-1.13)	**1.10** (0.866-1.37)	**1.40** (1.10-1.75)	**1.65** (1.29-2.08)	**2.00** (1.51-2.62)	**2.26** (1.67-3.02)	**2.53** (1.82-3.52)	**2.85** (1.93-4.02)	**3.32** (2.16-4.83)	**3.72** (2.35-5.50)
2-hr	**1.16** (0.926-1.44)	**1.41** (1.13-1.75)	**1.83** (1.45-2.27)	**2.17** (1.71-2.71)	**2.64** (2.02-3.46)	**2.99** (2.24-4.00)	**3.37** (2.46-4.69)	**3.84** (2.60-5.38)	**4.55** (2.96-6.58)	**5.16** (3.28-7.60)
3-hr	**1.34** (1.07-1.65)	**1.64** (1.31-2.02)	**2.13** (1.70-2.63)	**2.53** (2.01-3.15)	**3.09** (2.37-4.03)	**3.50** (2.64-4.68)	**3.96** (2.90-5.50)	**4.52** (3.07-6.30)	**5.39** (3.51-7.76)	**6.15** (3.91-9.01)
6-hr	**1.71** (1.38-2.10)	**2.10** (1.70-2.57)	**2.74** (2.20-3.36)	**3.26** (2.60-4.03)	**3.98** (3.08-5.16)	**4.52** (3.42-5.99)	**5.10** (3.76-7.05)	**5.83** (3.98-8.09)	**6.98** (4.57-9.99)	**7.98** (5.09-11.6)
12-hr	**2.17** (1.77-2.64)	**2.66** (2.16-3.23)	**3.46** (2.80-4.22)	**4.12** (3.32-5.05)	**5.03** (3.92-6.47)	**5.70** (4.34-7.50)	**6.44** (4.76-8.82)	**7.35** (5.04-10.1)	**8.76** (5.75-12.5)	**9.99** (6.39-14.5)
24-hr	**2.59** (2.13-3.13)	**3.21** (2.63-3.87)	**4.21** (3.44-5.09)	**5.04** (4.09-6.13)	**6.18** (4.85-7.90)	**7.02** (5.39-9.18)	**7.94** (5.92-10.8)	**9.10** (6.27-12.4)	**10.9** (7.19-15.4)	**12.5** (8.02-18.0)
2-day	**2.94** (2.43-3.52)	**3.69** (3.05-4.42)	**4.92** (4.05-5.91)	**5.94** (4.86-7.17)	**7.34** (5.80-9.34)	**8.36** (6.48-10.9)	**9.50** (7.16-13.0)	**11.0** (7.59-14.9)	**13.3** (8.81-18.7)	**15.4** (9.93-22.0)
3-day	**3.22** (2.68-3.83)	**4.02** (3.34-4.80)	**5.34** (4.42-6.39)	**6.43** (5.29-7.74)	**7.94** (6.31-10.1)	**9.04** (7.03-11.7)	**10.3** (7.76-13.9)	**11.8** (8.21-16.0)	**14.4** (9.54-20.1)	**16.7** (10.8-23.7)
4-day	**3.48** (2.91-4.14)	**4.31** (3.60-5.13)	**5.67** (4.71-6.77)	**6.80** (5.61-8.16)	**8.35** (6.66-10.6)	**9.49** (7.40-12.3)	**10.7** (8.15-14.6)	**12.4** (8.60-16.7)	**15.0** (9.97-20.9)	**17.4** (11.2-24.6)
7-day	**4.22** (3.55-4.99)	**5.09** (4.27-6.02)	**6.50** (5.44-7.71)	**7.67** (6.37-9.15)	**9.29** (7.44-11.6)	**10.5** (8.20-13.4)	**11.8** (8.95-15.8)	**13.5** (9.39-18.0)	**16.2** (10.8-22.4)	**18.5** (12.0-26.1)
10-day	**4.90** (4.14-5.77)	**5.79** (4.88-6.82)	**7.24** (6.08-8.56)	**8.45** (7.04-10.0)	**10.1** (8.12-12.6)	**11.3** (8.88-14.4)	**12.7** (9.61-16.8)	**14.3** (10.0-19.1)	**17.0** (11.3-23.4)	**19.3** (12.5-27.1)
20-day	**6.85** (5.84-8.00)	**7.82** (6.66-9.15)	**9.41** (7.97-11.0)	**10.7** (9.02-12.6)	**12.5** (10.1-15.4)	**13.9** (10.9-17.4)	**15.3** (11.6-19.9)	**17.0** (12.0-22.4)	**19.3** (13.0-26.4)	**21.2** (13.8-29.6)
30-day	**8.48** (7.26-9.86)	**9.52** (8.14-11.1)	**11.2** (9.55-13.1)	**12.6** (10.7-14.8)	**14.6** (11.8-17.7)	**16.1** (12.6-19.9)	**17.6** (13.2-22.4)	**19.2** (13.6-25.2)	**21.3** (14.3-29.0)	**23.0** (15.0-31.9)
45-day	**10.5** (9.06-12.2)	**11.7** (10.0-13.5)	**13.5** (11.5-15.7)	**15.0** (12.7-17.5)	**17.1** (13.9-20.6)	**18.7** (14.7-23.0)	**20.3** (15.2-25.7)	**21.9** (15.6-28.7)	**23.9** (16.1-32.3)	**25.3** (16.5-35.0)
60-day	**12.3** (10.6-14.2)	**13.5** (11.6-15.6)	**15.4** (13.2-17.9)	**17.0** (14.5-19.8)	**19.2** (15.6-23.1)	**21.0** (16.5-25.6)	**22.6** (17.0-28.4)	**24.2** (17.3-31.6)	**26.1** (17.7-35.2)	**27.5** (18.0-37.9)

[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.

Estimates from the table in CSV format: Precipitation frequency estimates Submit

Manning's Number Tables

Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
Closed Conduits	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe	
Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic)	
Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgtn.)	
Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay	
Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017
Open Channels	
Lined Channels	
Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged	
Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet)	
Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.

USDA Soil Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Middlesex County, Massachusetts

August 7, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,190 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 1:24,000.

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 24, Aug 27, 2024

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
52A	Freetown muck, 0 to 1 percent slopes	0.3	0.3%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	8.8	9.2%
302C	Montauk fine sandy loam, 8 to 15 percent slopes, extremely stony	10.2	10.6%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	40.7	42.6%
602	Urban land	13.0	13.6%
603	Urban land, wet substratum	14.4	15.0%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	6.9	7.3%
655	Udorthents, wet substratum	1.2	1.3%
656	Udorthents-Urban land complex	0.1	0.1%
Totals for Area of Interest		**95.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They

generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, swamps, kettles, marshes, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

73B—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w695
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting

Landform: Drumlins, ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury, extremely stony

Percent of map unit: 10 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions, outwash terraces, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Marshes, bogs, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, extremely stony

Percent of map unit: 1 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

302C—Montauk fine sandy loam, 8 to 15 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w80s
Elevation: 0 to 1,080 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Montauk, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Montauk, Extremely Stony

Setting

Landform: Hills, recessionial moraines, ground moraines, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 6 inches: fine sandy loam
Bw1 - 6 to 28 inches: fine sandy loam
Bw2 - 28 to 36 inches: sandy loam
2Cd - 36 to 74 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate, extremely stony

Percent of map unit: 8 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Canton, extremely stony

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 2 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

317B—Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 992p
Elevation: 70 to 1,200 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Scituate and similar soils: 85 percent

Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scituate

Setting

Landform: Depressions, hillslopes
Landform position (two-dimensional): Summit, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over dense sandy lodgment till derived from granite and gneiss

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 20 inches: sandy loam
H3 - 20 to 27 inches: loamy fine sand
H4 - 27 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 18 to 33 inches to densic material
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Montauk

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Head slope, nose slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

Woodbridge

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, toeslope
Landform position (three-dimensional): Head slope, nose slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, loamy

Percent of map unit: 5 percent

Hydric soil rating: No

603—Urban land, wet substratum

Map Unit Setting

National map unit symbol: 9951
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land over alluvium and/or marine deposits

Minor Components

Udorthents, loamy

Percent of map unit: 10 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

623C—Woodbridge-Urban land complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w68b
Elevation: 0 to 550 feet
Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Woodbridge and similar soils: 58 percent
Urban land: 28 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Paxton
Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury
Percent of map unit: 5 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

655—Udorthents, wet substratum

Map Unit Setting
National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents, wet substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

656—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 995k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Terraces, plains
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Paxton

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Head slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex

Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

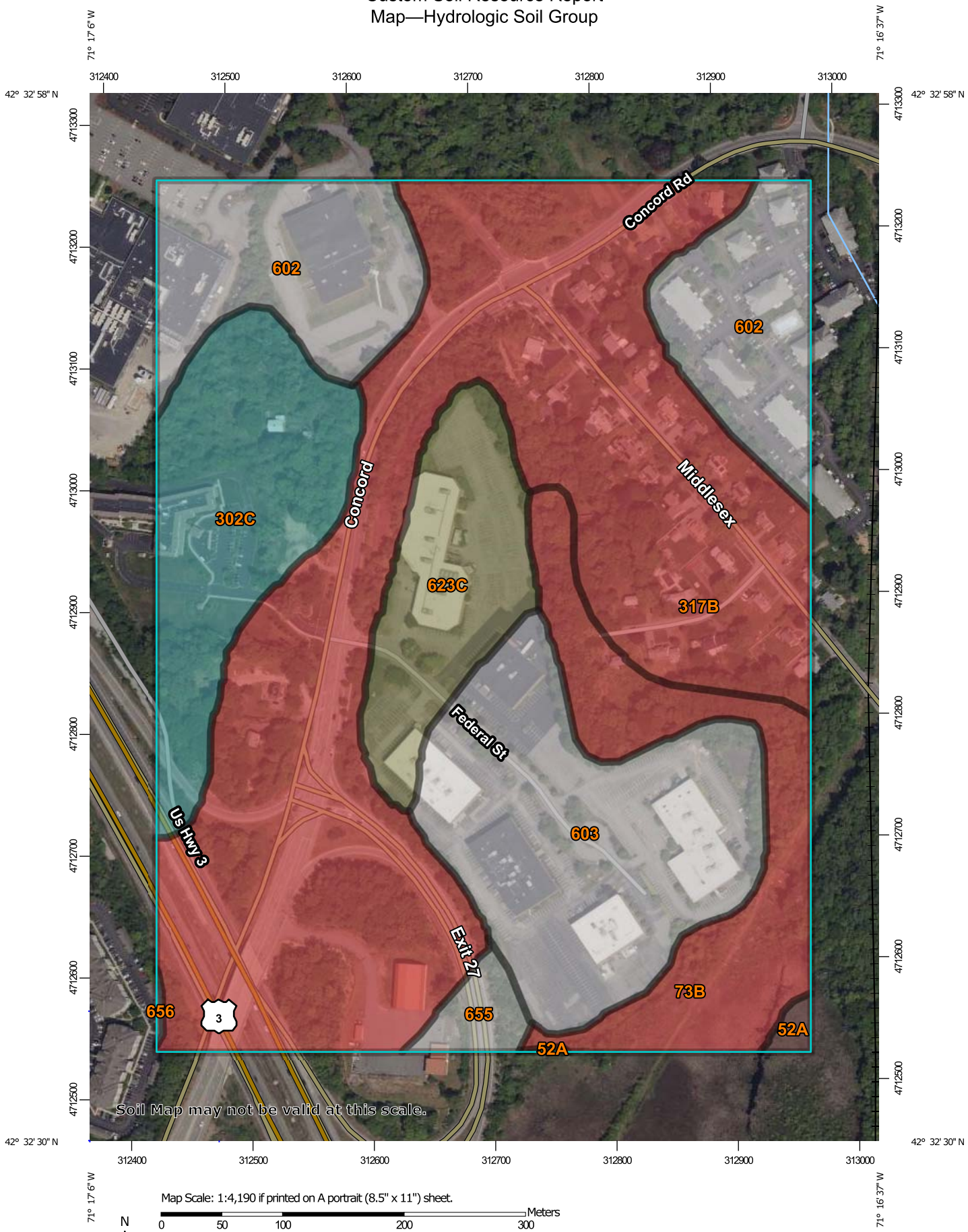
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Custom Soil Resource Report
Map—Hydrologic Soil Group



Map Scale: 1:4,190 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 1:24,000.

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 24, Aug 27, 2024

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

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

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
52A	Freetown muck, 0 to 1 percent slopes	B/D	0.3	0.3%
73B	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	8.8	9.2%
302C	Montauk fine sandy loam, 8 to 15 percent slopes, extremely stony	C	10.2	10.6%
317B	Scituate fine sandy loam, 3 to 8 percent slopes, extremely stony	D	40.7	42.6%
602	Urban land		13.0	13.6%
603	Urban land, wet substratum		14.4	15.0%
623C	Woodbridge-Urban land complex, 3 to 15 percent slopes	C/D	6.9	7.3%
655	Udorthents, wet substratum		1.2	1.3%
656	Udorthents-Urban land complex		0.1	0.1%
Totals for Area of Interest			**95.7**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

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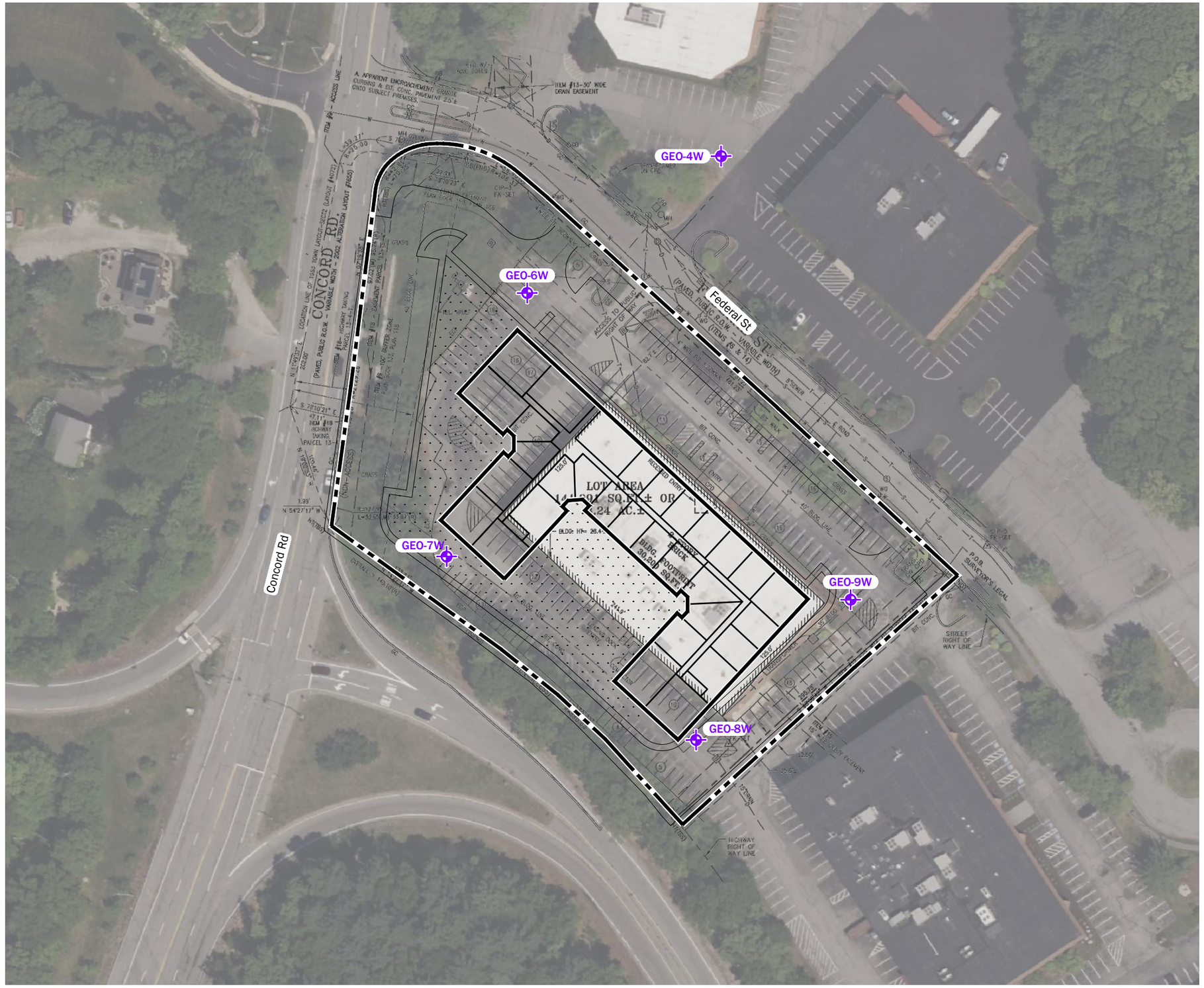
Form 11 Test Pit Logs



Legend

- Site Boundary
- Proposed Building
- GEO-4W — Boring with Groundwater Monitoring Well by GeoEngineers, June to July, 2025

Sources:

- Aerial from Mircosoft Bing
- Background from Co-Operative Land Surveyors, LLC, dated 2006
- Proposed Features from Embarc, dated 04/11/2025

Coordinate System: Massachusetts State Plane, Mainland Zone, NAD83, US Foot

N

0 80

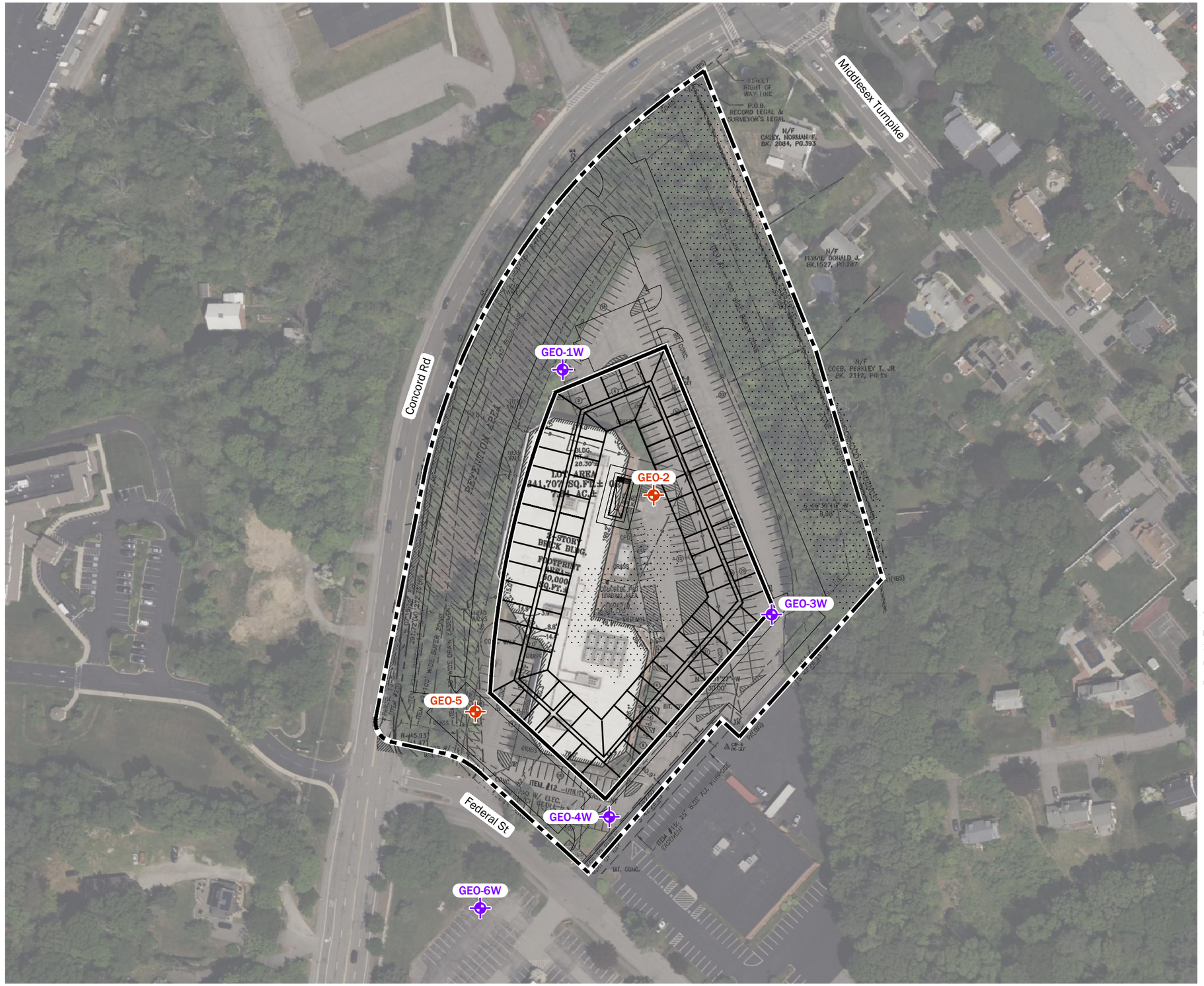
Feet

Exploration Location Plan

Geotechnical Engineering Memorandum
1 Federal Street
Billerica, Massachusetts

GeoEngineers USA

Figure 2a



Legend

- Site Boundary
- Proposed Building
- GEO-2 — Boring by GeoEngineers, June to July 2025
- GEO-1W — Boring with Groundwater Monitoring Well by GeoEngineers, June to July, 2025

Sources:

- Aerial from Mircosoft Bing
- Background from Co-Operative Land Surveyors, LLC, dated 2006
- Proposed Features from Embarc, dated 04/11/2025

Coordinate System: Massachusetts State Plane, Mainland Zone, NAD83, US Foot

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

N

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Feet

Exploration Location Plan

Geotechnical Engineering Memorandum
2 Federal Street
Billerica, Massachusetts

GeoEngineers USA

Figure 2b

P:\28\28165001\CAD\00\Geotech\28165001000_F02_ELP.dwg 2b Date Exported:7/17/2025 1:07 PM - by Lisa Witkowski

Attachment A
Subsurface Exploration Logs

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

Modified California Sampler (6-inch sleeve) or Dames & Moore

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers USA

Figure A-1

Rev. 03/2024

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	7/2/2025	7/2/2025	25.75	DRE	SSS	Soil X. Corp.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted Drill Rig Acker AD2
Surface Elevation (ft) Vertical Datum	192	Top of Casing Elevation (ft)	191.50
Easting (X) Northing (Y)	715009 3024399	Horizontal Datum	MA State Plane Mainland NAD83 (feet)

DOE Well I.D.: GEO-1W
A 2-in well was installed on 7/2/2025 to a depth of 14 ft.

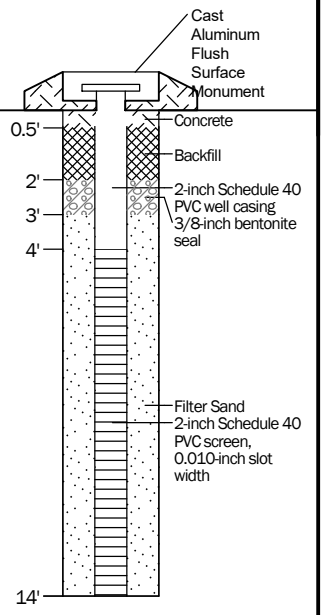
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/9/2025	7.31	184.19

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppmv)
	0								AC	Asphalt pavement		ND
190			5	57		S-1			SP	Poorly Graded Sand with Silt and Gravel (SP), very dense, black to brown, moist; fine to medium sand with gravel, trace silt and cobble/rock fragments (fill)		
			3	39		S-2						ND
			24	30		S-3			SP-SM	Poorly Graded Sand with Silt and Gravel (SP-SM), dense, grayish brown, moist; fine to medium sand with silt and gravel (redoximorphic features)		ND
185	5		18	38		S-4	▼					ND
			18	29		S-5				Becomes medium dense and wet Groundwater encountered at approximately 8 feet during drilling		ND
	10		18	30		S-6						ND
180												
	15		11	51/5"		S-7				Becomes very dense		ND
175										Becomes light gray		
	20		22	73		S-8						ND
170												
	25		9	51/3"		S-9						ND

Split spoon refusal at approximately 25¾ feet
GEO-1 was completed as 2-inch groundwater monitoring well

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Monitoring Well GEO-1W

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-2
Sheet 1 of 1

Drilled: Start 7/1/2025 End 7/1/2025	Total Depth (ft) 26.5	Logged By DRE / Checked By SSS	Driller Soil X. Corp.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) / Vertical Datum 192		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Truck-mounted Drill Rig Acker AD2	
Easting (X) 715118 / Northing (Y) 3024249		System Datum MA State Plane Mainland NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppmv)	REMARKS
190	0							AC	Asphalt pavement		1.2	
			12	14		S-1		SP-SM	Poorly Graded Sand with Silt and Gravel (SP-SM), medium dense, dark brown to brown, dry to moist; fine to medium sand with silt and gravel (fill)		ND	
			24	28		S-2		SM	Silty Sand with Gravel (SM), medium dense, grayish brown, moist; silty fine to medium sand with gravel			
			3	51/3"		S-3			Becomes very dense; coarser and with boulder fragments		3.1	
185	5		9	51/5"		S-4			Becomes wet		ND	Groundwater encountered at approximately 6 feet during drilling
	10		1	51/1"		S-5		SP-SM	Poorly Graded Sand with Silt and Gravel (SP-SM), very dense, grayish brown, wet; fine to coarse sand with silt and gravel		ND	
180												
	15		14	60		S-6					ND	
175												
	20		8	51/3"		S-7A					ND	
						S-7B		SM	Silty Sand with Gravel (SM), very dense, light gray, wet; silty fine to medium sand with gravel and cobble/boulder fragment		ND	
170												
	25		17	51/5"		S-8					ND	

Split spoon refusal at approximately 26½ feet
GEO-2 was backfilled with soil cuttings and patched with cold asphalt mix at ground surface

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Date:7/18/25 Path:P:\28\28165001\GINT\28165000100.GPJ DBLibrary/Library:GEOUSA_DF_STD_US.GLB/GEI8_ENVIRONMENTAL_STANDARD_NO_GW

Log of Boring GEO-2

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-3
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	7/1/2025	7/1/2025	25.5	DRE	SSS	Soil X. Corp.	Hollow-stem Auger

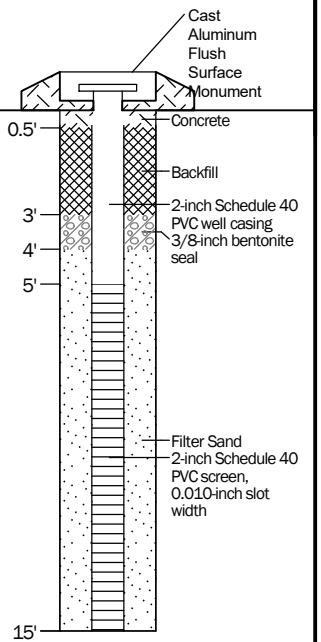
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted Drill Rig Acker AD2
Surface Elevation (ft) Vertical Datum	193	Top of Casing Elevation (ft)	192.60
Easting (X) Northing (Y)	715260 3024106	Horizontal Datum	MA State Plane Mainland NAD83 (feet)

DOE Well I.D.: GEO-3W
A 2-in well was installed on 7/1/2025 to a depth of 15 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/9/2025	6.47	186.13

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppmv)
	0								AC	Asphalt Pavement		1.2
			12	19		S-1			SP-SM	Poorly Graded Sand with Gravel (SP-SM), medium dense, dark brown, dry; fine to medium sand with silt and gravel (fill)		
190			18	66		S-2			SP	Poorly Graded Sand with Gravel (SP), very dense, gray, moist; fine to coarse sand with gravel and trace silt (fill)		ND
			17	42		S-3				Becomes dense		ND
	5								SP	Poorly Graded Sand with Gravel (SP), very dense, brownish gray, moist; fine to medium sand with gravel and trace silt		
			14	40		S-4	▼		SP-SM	Poorly Graded Sand with Silt and Gravel (SP-SM), dense, brownish gray, moist; fine to medium sand with silt, gravel and track rock fragments		1.0
185			17	27		S-5				Becomes medium dense, gray, wet; fine to coarse sand with silt and gravel		ND
	10		20	36		S-6				Groundwater encountered at approximately 8 feet during drilling Becomes dense		ND
180												
	15		10	51/4"		S-7				Becomes very dense		1.1
175												
	20		5	51/5"		S-8						ND
170												
	25		3	51/5"		S-9			SM	Silty Sand with Gravel (SM), very dense, light gray, wet; silty fine to medium sand with gravel (till)		ND
										Split spoon refusal at approximately 25½ feet GEO-3 was completed as 2-inch groundwater monitoring well.		



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Monitoring Well GEO-3W

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-4
Sheet 1 of 1

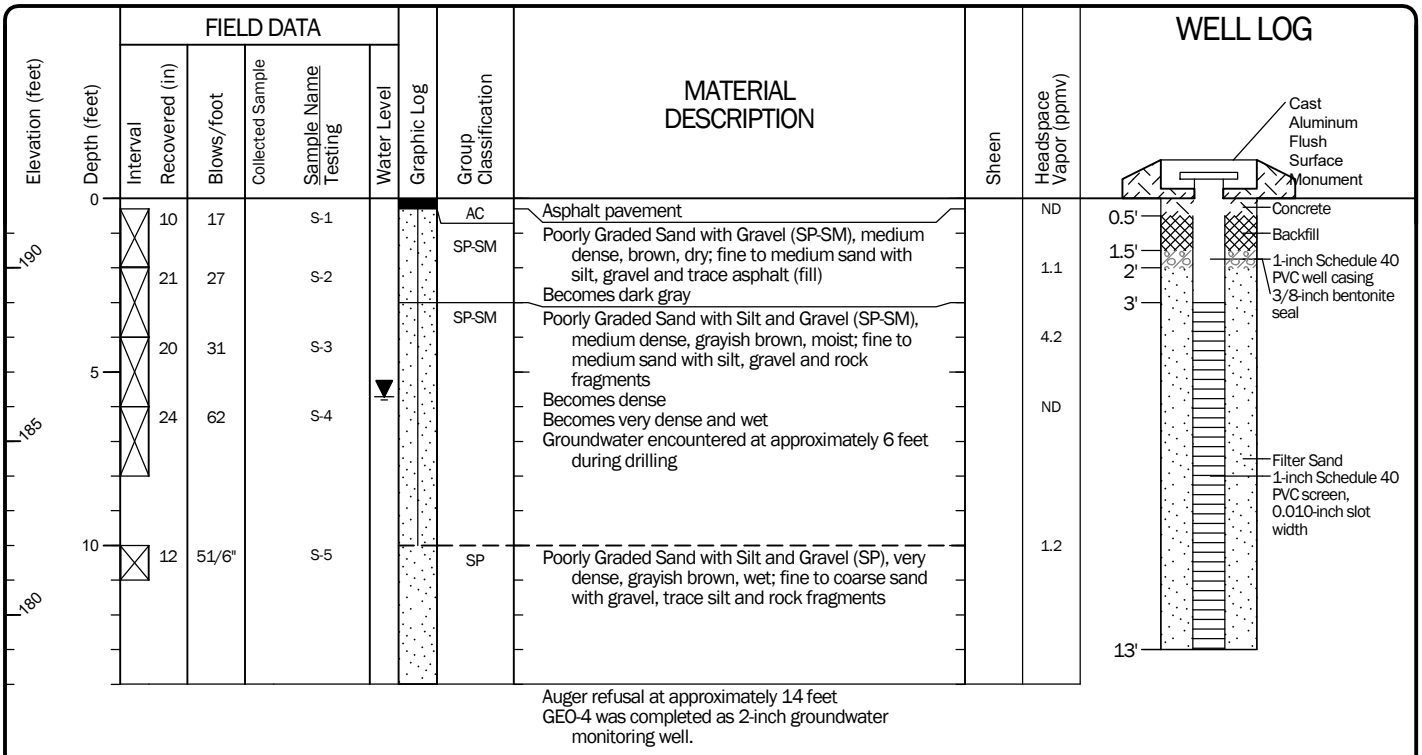
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	7/1/2025	7/1/2025	14	DRE	SSS	Soil X. Corp.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted Drill Rig Acker AD2
Surface Elevation (ft) Vertical Datum	192	Top of Casing Elevation (ft)	191.50
Easting (X) Northing (Y)	715065 3023864	Horizontal Datum	MA State Plane Mainland NAD83 (feet)

DOE Well I.D.: GEO-4W
A 2-in well was installed on 7/1/2025 to a depth of 13 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/9/2025	5.71	185.79

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Monitoring Well GEO-4W

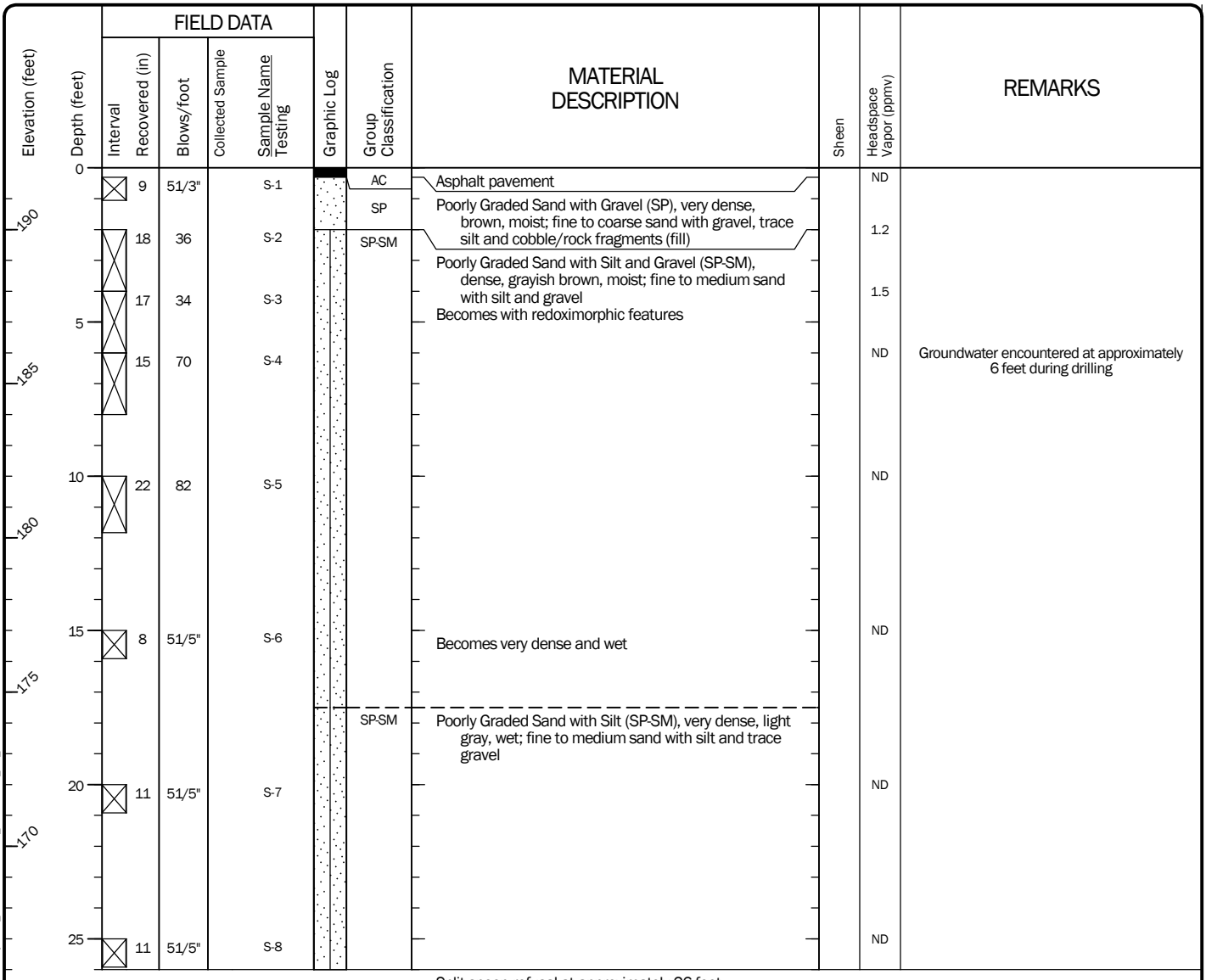
GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-5
Sheet 1 of 1

Drilled	Start 7/2/2025	End 7/2/2025	Total Depth (ft) 26	Logged By DRE / Checked By SSS	Driller Soil X. Corp.	Drilling Method Hollow-stem Auger
Surface Elevation (ft) / Vertical Datum	192		Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Truck-mounted Drill Rig Acker AD2
Easting (X) / Northing (Y)	714904 / 3023990		System Datum	MA State Plane Mainland NAD83 (feet)	See "Remarks" section for groundwater observed	

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Boring GEO-5

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-6
Sheet 1 of 1

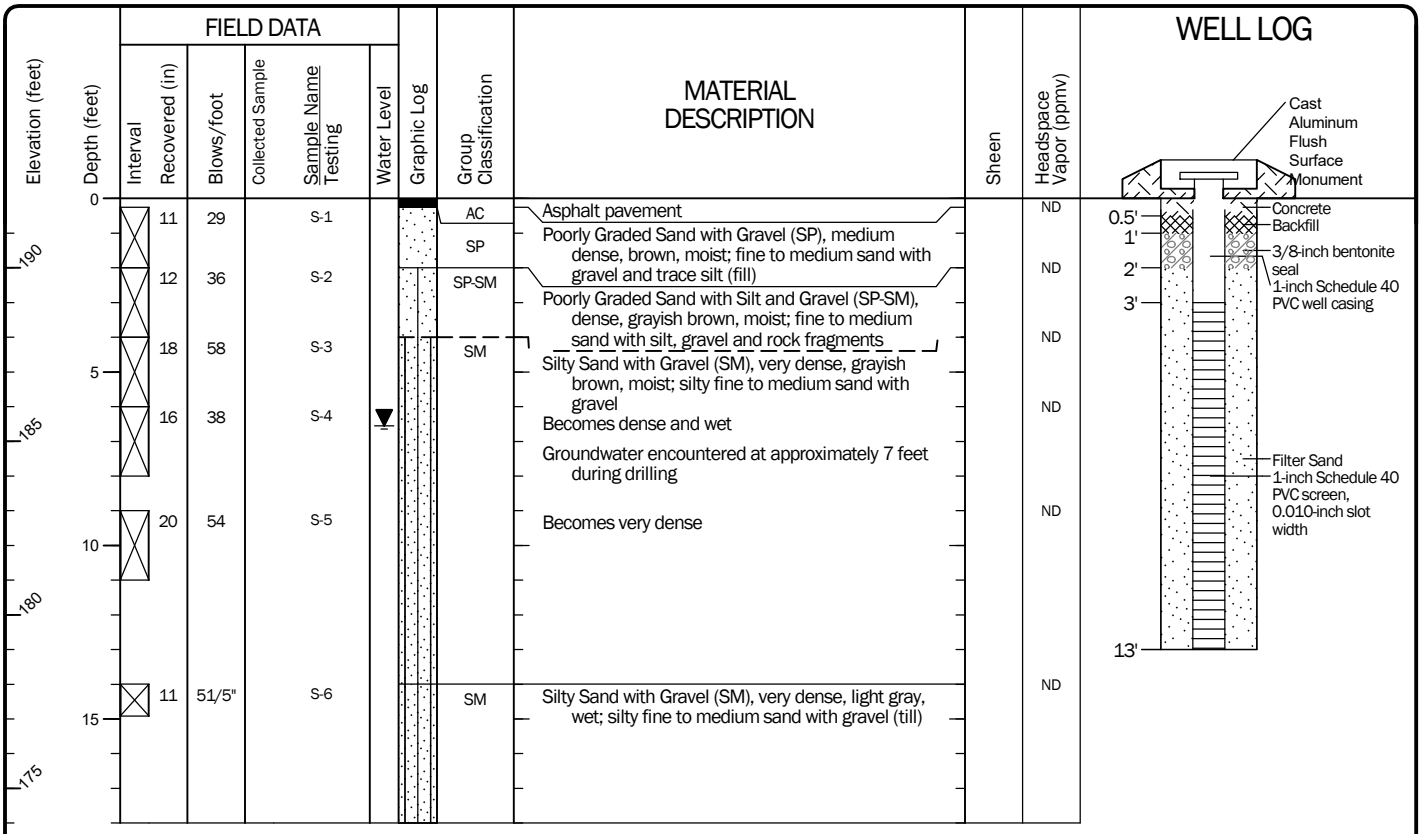
Drilled	Start	End	Total Depth (ft)		Logged By	DRE	Driller		Drilling Method	
	6/30/2025	6/30/2025	18		Checked By	SSS	Soil X. Corp.		Hollow-stem Auger	

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	ATV Drill Rig GeoProbe 7822 DT
Surface Elevation (ft) Vertical Datum	192	Top of Casing Elevation (ft)	191.70
Easting (X) Northing (Y)	714910 3023754	Horizontal Datum	MA State Plane Mainland NAD83 (feet)

DOE Well I.D.: GEO-6W
A 1-in well was installed on 6/30/2025 to a depth of 13 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/9/2025	6.55	185.15

Notes:



Matrix core refusal at approximately 18 feet
GEO-6 was completed as 1-inch groundwater monitoring well.

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Monitoring Well GEO-6W

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-7
Sheet 1 of 1

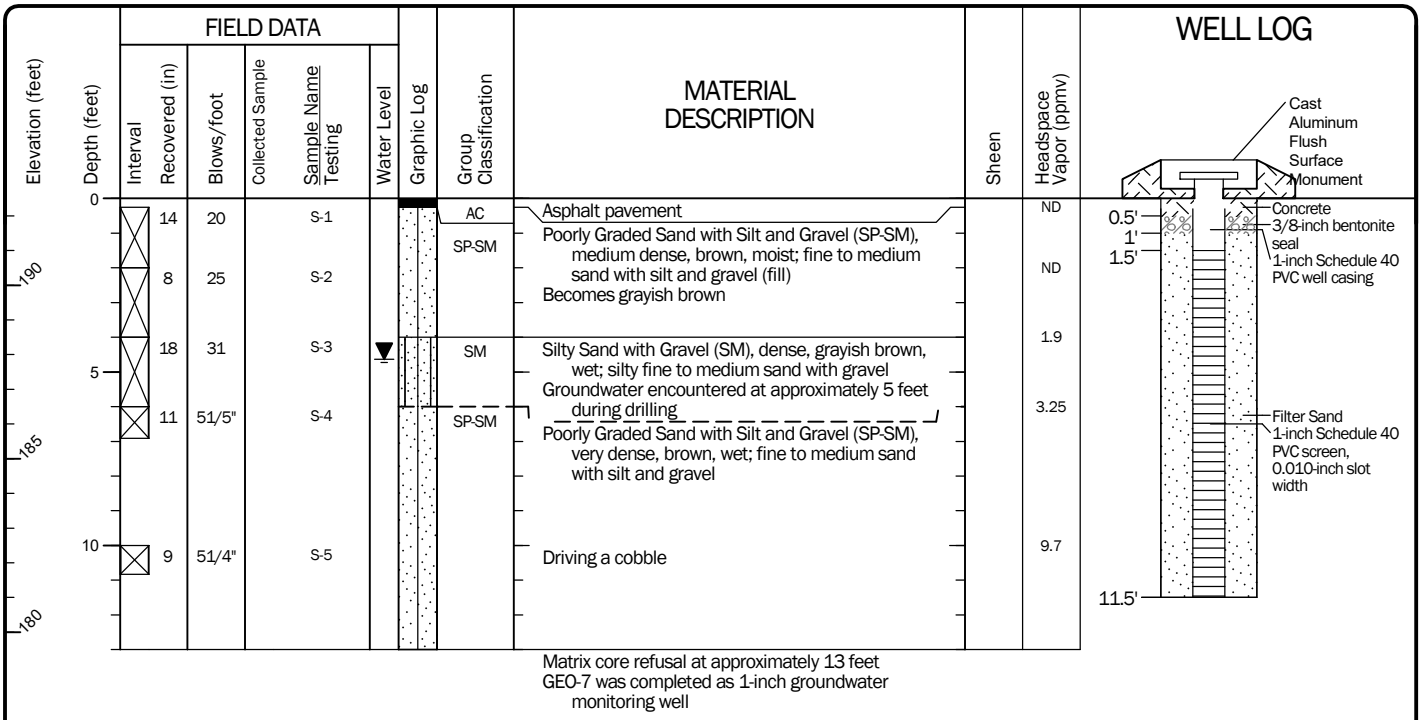
Drilled	Start 6/30/2025	End 6/30/2025	Total Depth (ft)	13	Logged By / Checked By	DRE / SSS	Driller: Soil X. Corp.	Drilling Method: Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	ATV Drill Rig GeoProbe 7822 DT
Surface Elevation (ft) Vertical Datum	192.5	Top of Casing Elevation (ft)	192.20
Easting (X) Northing (Y)	714846 3023544	Horizontal Datum	MA State Plane Mainland NAD83 (feet)

DOE Well I.D.: GEO-7W
A 1-in well was installed on 6/30/2025 to a depth of 11.5 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/9/2025	4.63	187.57

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Monitoring Well GEO-7W

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-8
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	6/30/2025	7/2/2025	24	DRE	SSS	Soil X. Corp.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	ATV/Truck-mounted Drill Rig GeoProbe 7822 DT/Acker DT2
Surface Elevation (ft) Vertical Datum	190	Top of Casing Elevation (ft)	189.70
Easting (X) Northing (Y)	715045 3023398	Horizontal Datum	MA State Plane Mainland NAD83 (feet)

DOE Well I.D.: GEO-8W
A 1-in well was installed on 6/30/2025 to a depth of 9.5 ft.

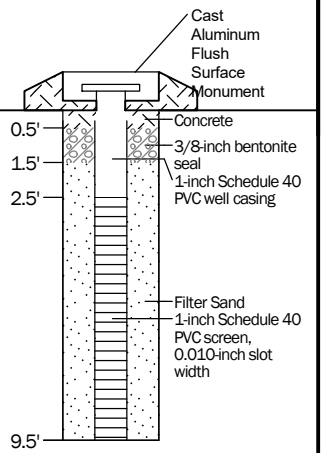
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/9/2025	2.92	186.78

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppmv)
	0								AC	Asphalt pavement		ND
			5	25		S-1			SP	Poorly Graded Sand with Silt and Gravel (SP), medium dense, black to grayish brown, moist; fine to medium sand with gravel and silt (fill)		
			24	47		S-2			SM	Silty Sand with Gravel (SM), dense, grayish brown, moist to wet; silty fine to medium sand with gravel		ND
185	5		18	41		S-3				Groundwater encountered at approximately 3½ feet during drilling Becomes wet		ND
180	10		5	51/5"		S-4				Becomes very dense		2.9
			17	89		S-5			SP-SM	Poorly Graded Sand with Silt and Gravel (SP-SM), very dense, brownish gray, wet; fine to medium sand with silt and gravel		ND
175	15		11	51/5"		S-6			SM	Silty Sand with Gravel (SM), very dense, brownish gray, wet; silty fine to medium sand with gravel (till)		1.1
170	20		3	51/5"		S-7						ND

Matrix core refusal at approximately 9½ feet
GEO-8 was offset 5 feet and switched from GeoProbe 7822 DT to Acket DT2.
Boring terminated at approximately 24 feet
GEO-8 was completed as 1-inch groundwater monitoring well
GEO-8 offset was backfilled with soil cuttings and patched with concrete at ground surface

WELL LOG



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Monitoring Well GEO-8W

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-9
Sheet 1 of 1

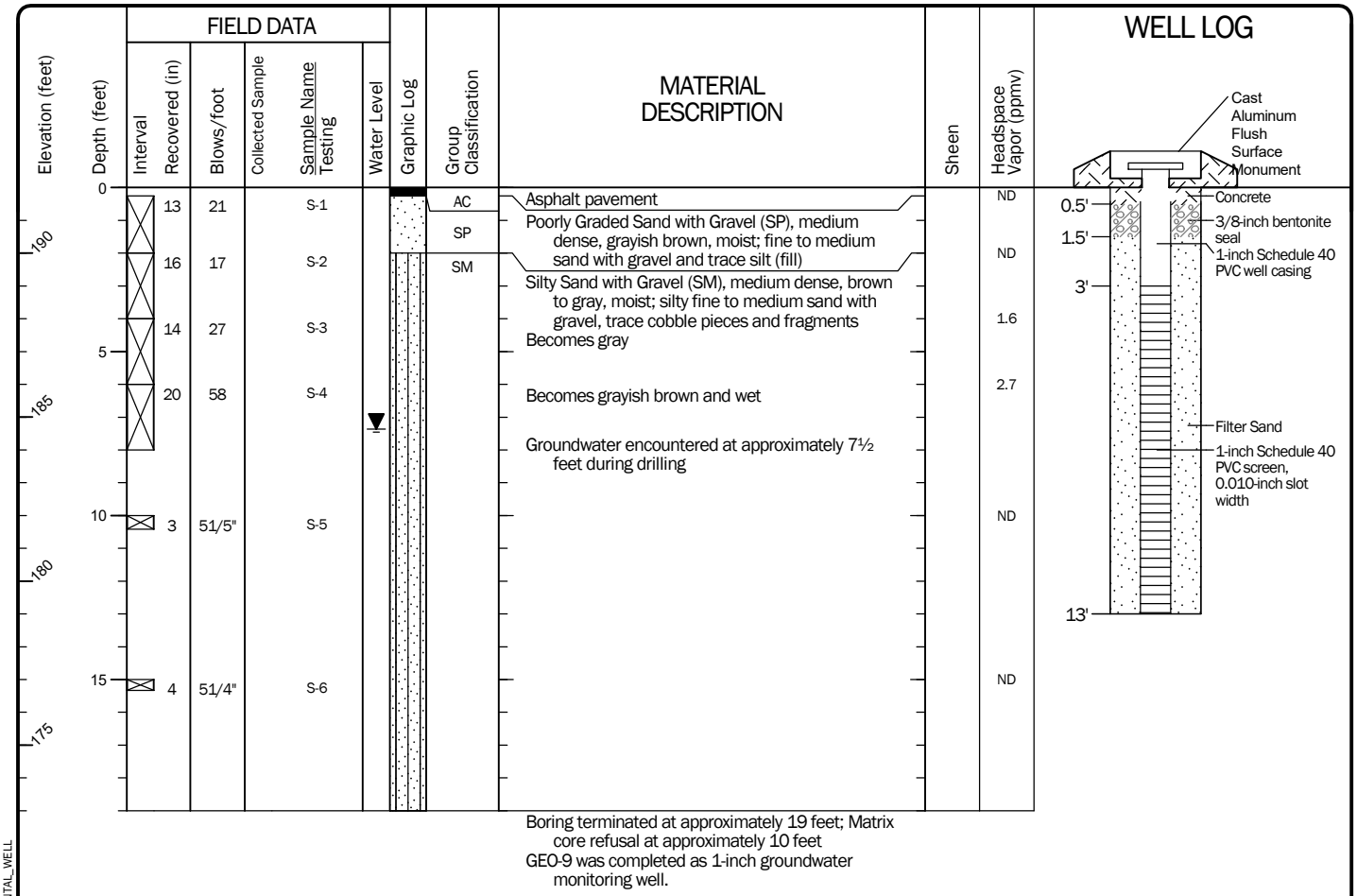
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	6/30/2025	6/30/2025	19	DRE	SSS	Soil X. Corp.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	ATV Drill Rig GeoProbe 7822 DT
Surface Elevation (ft) Vertical Datum	192	Top of Casing Elevation (ft)	191.60
Easting (X) Northing (Y)	715168 3023510	Horizontal Datum	MA State Plane Mainland NAD83 (feet)

DOE Well I.D.: GEO-9W
A 1-in well was installed on 6/30/2025 to a depth of 9.5 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
7/9/2025	7.36	184.24

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Other. Vertical approximated based on Google Earth.

Log of Monitoring Well GEO-9W

GeoEngineers USA

Project: 1&2 Federal Street
Project Location: Billerica, Massachusetts
Project Number: 28165-001-00

Figure A-10
Sheet 1 of 1

Stormwater Pipe Sizing Calculation

ALLEN & MAJOR ASSOCIATES, INC.

DESIGN YEAR: 25.00

K= 230.00 B= 30

Title ***Stormwater Conveyance Sizing (25 YEAR STORM)***

Project ***JLB Billerica - Billerica, MA***

Date 11-03-2025

A&M Project Number: 3490-03

Minimum Slope:	0.005	
Minimum Size:	12.000	inch
Rainfall Intensity (in/hr):	6.030	(25 year storm)
Manning's n:	0.012	HDPE
Manning's n:	0.013	RCP
Min. Velocity:	2.000	fps
Max. Velocity:	12.000	fps

From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Manning's Roughness	Peak Flow (cfs)	Time of Peak Flow (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth (ft)	Reported Condition
1 Federal Street																
PCB 203A	PDMH 203	25.73	188.33	188.20	0.5200	CIRCULAR	15.000	0.0120	3.51	0 00:06	4.45	0.10	5.04	0.70	0.77	Calculated
PDMH 203	PDMH 202	120.44	188.20	187.58	0.5200	CIRCULAR	15.000	0.0120	4.53	0 00:06	4.74	0.42	5.04	0.90	0.92	Calculated
PCB 201A	PDMH 201	7.78	193.10	193.06	0.5000	CIRCULAR	12.000	0.0120	0.96	0 00:06	3.18	0.04	2.73	0.35	0.41	Calculated
PDMH 201	Out-1Pipe - (34)	59.42	187.05	186.75	0.5000	CIRCULAR	18.000	0.0120	7.78	0 00:07	5.33	0.19	8.05	0.97	1.18	Calculated
PDMH 402	PDMH 401	35.49	188.11	187.75	1.0000	CIRCULAR	15.000	0.0120	7.57	0 00:06	6.74	0.09	7.00	1.08	1.25	URCHARGED
PDMH 401	PDMH 400	14.31	187.65	187.51	1.0000	CIRCULAR	15.000	0.0120	7.56	0 00:05	6.67	0.04	7.00	1.08	1.25	URCHARGED
PCB 403A	PDMH 403	18.66	188.94	188.57	2.0000	CIRCULAR	12.000	0.0120	1.72	0 00:06	6.16	0.05	5.46	0.31	0.38	Calculated
PDMH 403	PDMH 402	102.17	188.47	187.96	0.5000	CIRCULAR	15.000	0.0120	3.80	0 00:06	4.51	0.38	4.95	0.77	0.82	Calculated
PCB 401A	PDMH 401	6.70	187.72	187.68	0.5000	CIRCULAR	12.000	0.0120	1.27	0 00:06	3.42	0.03	2.73	0.46	0.48	Calculated
PCB 400A	PDMH 400	8.62	187.55	187.51	0.5000	CIRCULAR	12.000	0.0120	0.00	0 00:00	0.00		2.73	0.00	0.00	Calculated
PCB 405A	PDMH 405	13.27	188.96	188.89	0.5000	CIRCULAR	12.000	0.0120	1.65	0 00:06	3.64	0.06	2.73	0.60	0.56	Calculated
PDMH 404	PDMH 402	27.67	188.10	187.96	0.5000	CIRCULAR	15.000	0.0120	3.94	0 00:06	4.53	0.10	4.95	0.80	0.84	Calculated
PDMH 405	PDMH 404	118.73	188.79	188.20	0.5000	CIRCULAR	12.000	0.0120	2.95	0 00:07	4.16	0.48	2.73	1.08	0.94	> CAPACITY
PCB 202A	PDMH 202	6.35	187.61	187.58	0.5000	CIRCULAR	12.000	0.0120	0.63	0 00:06	2.83	0.04	2.74	0.23	0.32	Calculated
PDMH 202	PDMH 201	65.77	187.48	187.15	0.5000	CIRCULAR	15.000	0.0120	5.35	0 00:06	4.74	0.23	4.95	1.08	1.14	> CAPACITY
PCB 402A	PDMH 402	26.46	188.09	187.96	0.5000	CIRCULAR	12.000	0.0120	0.90	0 00:06	3.25	0.14	2.73	0.33	0.39	Calculated
CY-AD2	CY-AD1	47.17	189.40	189.16	0.5000	CIRCULAR	12.000	0.0120	1.59	0 00:06	3.63	0.22	2.73	0.58	0.55	Calculated
CY-AD1	PDMH 403	59.05	189.16	188.57	1.0000	CIRCULAR	12.000	0.0120	2.18	0 00:06	5.08	0.19	3.86	0.56	0.54	Calculated
CY-AD3	CY-AD2	77.57	189.78	189.40	0.5000	CIRCULAR	12.000	0.0120	1.11	0 00:06	4.55	0.28	2.73	0.41	0.44	Calculated
PDMH 400	Out-1Pipe - (58)	285.02	187.51	186.01	0.5300	CIRCULAR	12.000	0.0120	3.03	0 00:03	5.34	0.89	2.80	1.08	1.00	URCHARGED
BLDG 1 - 1 FED	PDMH 201	45.85	193.29	193.06	0.5000	CIRCULAR	12.000	0.0120	1.90	0 00:06	4.74	0.16	2.73	0.70	0.61	Calculated
BLDG 2 - 1 FED	PDMH 203	37.34	188.39	188.20	0.5000	CIRCULAR	12.000	0.0120	1.09	0 00:06	3.99	0.16	2.73	0.40	0.44	Calculated
BLDG 3 - 1 FED	PDMH 404	39.19	188.39	188.20	0.5000	CIRCULAR	12.000	0.0120	1.08	0 00:06	4.01	0.16	2.73	0.40	0.44	Calculated
BLDG 4 - 1 FED	PDMH 405	78.96	191.10	190.71	0.5000	CIRCULAR	12.000	0.0120	1.50	0 00:06	5.09	0.26	2.73	0.55	0.53	Calculated

*Existing discharge pipe exiting 1 Federal Street operates under a surcharged condition. No known problems have been observed in this location. Runoff may pond locally onsite until the pipe capacity reaches free flow conditions.

ALLEN & MAJOR ASSOCIATES, INC.

DESIGN YEAR: 25.00

K= 230.00 B= 30

Title ***Stormwater Conveyance Sizing (25 YEAR STORM)***

Project ***JLB Billerica - Billerica, MA***

Date 11-03-2025

A&M Project Number: 3490-03

Minimum Slope:	0.005	
Minimum Size:	12.000	inch
Rainfall Intensity (in/hr):	6.030	(25 year storm)
Manning's n:	0.012	HDPE
Manning's n:	0.013	RCP
Min. Velocity:	2.000	fps
Max. Velocity:	12.000	fps

From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Manning's Roughness	Peak Flow (cfs)	Time of Peak Flow (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth (ft)	Reported Condition
2 Federal Street																
PDMH 3	PDMH 2	94.27	186.46	186.27	0.2000	CIRCULAR	24.000	0.0120	6.89	0 00:07	3.72	0.42	10.96	0.63	1.15	Calculated
PDMH 2	PDMH 1 (WQS)	100.00	186.27	186.07	0.2000	CIRCULAR	24.000	0.0120	8.88	0 00:07	3.93	0.42	10.96	0.81	1.36	Calculated
PDMH 1 (WQS)	Out-1Pipe - (11) (1)	60.39	186.07	185.95	0.2000	CIRCULAR	24.000	0.0120	9.76	0 00:07	3.97	0.25	10.96	0.89	1.47	Calculated
PDMH 300	Out-1Pipe - (13)	74.53	186.67	185.92	1.0000	CIRCULAR	18.000	0.0120	4.91	0 00:06	6.35	0.20	11.38	0.43	0.69	Calculated
PDMH 104	PDMH 103	127.94	188.95	188.31	0.5000	CIRCULAR	12.000	0.0120	0.76	0 00:06	3.04	0.70	2.73	0.28	0.36	Calculated
PDMH 103	PDMH 102	79.47	188.21	187.81	0.5000	CIRCULAR	18.000	0.0120	2.94	0 00:06	4.23	0.31	8.05	0.37	0.63	Calculated
PDMH 102	PDMH 101	86.13	187.71	187.28	0.5000	CIRCULAR	18.000	0.0120	4.37	0 00:06	4.68	0.31	8.05	0.54	0.79	Calculated
PDMH 101	PDMH 100 (WQS)	147.62	187.18	186.44	0.5000	CIRCULAR	24.000	0.0120	10.48	0 00:06	5.85	0.42	17.33	0.60	1.12	Calculated
PDMH 100 (WQS)	Out-1Pipe - (19) (1)	84.65	186.34	185.92	0.5000	CIRCULAR	24.000	0.0120	12.68	0 00:06	6.05	0.23	17.33	0.73	1.27	Calculated
PCB 8A	PDMH 8	25.50	187.93	187.80	0.5000	CIRCULAR	12.000	0.0120	1.74	0 00:06	3.70	0.11	2.73	0.64	0.58	Calculated
PCB 4A (WQS)	PDMH 4A	7.24	187.75	187.71	0.5000	CIRCULAR	12.000	0.0120	2.17	0 00:06	3.86	0.03	2.72	0.80	0.67	Calculated
PCB2A	PDMH 2	109.38	189.50	188.95	0.5000	CIRCULAR	12.000	0.0120	0.92	0 00:06	4.76	0.38	2.73	0.34	0.40	Calculated
PCB 2A	PDMH 2	30.47	188.93	188.78	0.5000	CIRCULAR	12.000	0.0120	1.58	0 00:06	3.67	0.14	2.73	0.58	0.54	Calculated
PCB 100A	PDMH 100 (WQS)	26.20	188.79	188.66	0.5000	CIRCULAR	12.000	0.0120	2.31	0 00:06	3.92	0.11	2.73	0.85	0.70	Calculated
PCB 1A	PDMH 1 (WQS)	19.28	189.18	189.08	0.5000	CIRCULAR	12.000	0.0120	1.19	0 00:06	3.36	0.10	2.73	0.43	0.46	Calculated
PCB 101A	PDMH 101	34.86	188.98	188.81	0.5000	CIRCULAR	12.000	0.0120	1.21	0 00:06	3.74	0.16	2.73	0.44	0.47	Calculated
CY AD 1	PDMH 101	125.96	187.81	187.18	0.5000	CIRCULAR	15.000	0.0120	5.35	0 00:06	4.85	0.43	4.95	1.08	1.18	> CAPACITY
PCB 102A	PDMH 102	10.52	188.96	188.91	0.5000	CIRCULAR	12.000	0.0120	1.52	0 00:06	3.57	0.05	2.73	0.56	0.53	Calculated
PCB 103A	PDMH 103	37.03	188.67	188.48	0.5000	CIRCULAR	12.000	0.0120	2.25	0 00:06	4.21	0.15	2.73	0.82	0.69	Calculated
PCB 104A	PDMH 104	29.02	189.20	189.05	0.5000	CIRCULAR	12.000	0.0120	0.00	0 00:00	0.00		2.73	0.00	0.00	Calculated
PDMH 5A	PDMH 5	6.56	188.90	188.87	0.5000	CIRCULAR	12.000	0.0120	2.16	0 00:06	3.87	0.03	2.74	0.79	0.67	Calculated
PDMH 6A	PDMH 6	6.37	188.90	188.87	0.5200	CIRCULAR	12.000	0.0120	0.94	0 00:06	3.20	0.03	2.78	0.34	0.40	Calculated
PCB 5A (WQS)	PDMH 5A	7.81	187.76	187.72	0.5000	CIRCULAR	12.000	0.0120	2.17	0 00:06	3.86	0.03	2.73	0.79	0.67	Calculated
PCB 6A (WQS)	PDMH 6A	12.91	187.75	187.68	0.5000	CIRCULAR	12.000	0.0120	0.94	0 00:06	3.16	0.07	2.73	0.35	0.40	Calculated
CY AD 2	CY AD 1	47.07	188.38	187.91	1.0000	CIRCULAR	15.000	0.0120	5.71	0 00:05	6.40	0.12	7.00	0.82	0.85	Calculated
PDMH 8	PDMH 7	118.57	187.70	187.29	0.3500	CIRCULAR	18.000	0.0120	2.51	0 00:06	3.59	0.55	6.73	0.37	0.63	Calculated
PDMH 4A	PDMH 4	6.50	188.90	188.87	0.5100	CIRCULAR	12.000	0.0120	2.16	0 00:06	3.88	0.03	2.75	0.79	0.67	Calculated
BLDG 2	Out-1Pipe - (62) (2)	19.57	187.82	187.62	1.0000	CIRCULAR	12.000	0.0120	2.02	0 00:06	4.98	0.07	3.86	0.52	0.51	Calculated
BLDG 1	PDMH 8	40.23	188.20	187.80	1.0000	CIRCULAR	12.000	0.0120	0.84	0 00:06	4.68	0.14	3.86	0.22	0.32	Calculated
BLDG 6	PDMH 104	30.09	189.20	189.05	0.5000	CIRCULAR	12.000	0.0120	0.78	0 00:06	3.55	0.14	2.73	0.29	0.37	Calculated
PDMH 7	PDMH 6	14.98	187.25	187.22	0.2000	CIRCULAR	24.000	0.0120	2.50	0 00:06	2.83	0.09	10.96	0.23	0.65	Calculated

ALLEN & MAJOR ASSOCIATES, INC.

DESIGN YEAR: 25.00

K= 230.00 B= 30

Title ***Stormwater Conveyance Sizing (25 YEAR STORM)***

Project ***JLB Billerica - Billerica, MA***

Date 11-03-2025

A&M Project Number: 3490-03

Minimum Slope:	0.005	
Minimum Size:	12.000	inch
Rainfall Intensity (in/hr):	6.030	(25 year storm)
Manning's n:	0.012	HDPE
Manning's n:	0.013	RCP
Min. Velocity:	2.000	fps
Max. Velocity:	12.000	fps

From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Manning's Roughness	Peak Flow (cfs)	Time of Peak Flow (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth (ft)	Reported Condition
PDMH 6	PDMH 5	107.40	187.22	187.01	0.2000	CIRCULAR	24.000	0.0120	3.36	0 00:06	3.12	0.57	10.96	0.31	0.76	Calculated
BLDG 7	BLDG 8	72.79	188.98	188.61	0.5000	CIRCULAR	12.000	0.0120	0.00	0 00:00	0.00		2.73	0.00	0.00	Calculated
BLDG 8	BLDG 9	86.75	188.61	188.18	0.5000	CIRCULAR	12.000	0.0120	0.00	0 00:00	0.00		2.73	0.00	0.00	Calculated
BLDG 9	PDMH 300	283.87	188.18	186.76	0.5000	CIRCULAR	15.000	0.0120	4.92	0 00:06	8.52	0.56	4.95	0.99	1.05	Calculated
BLDG 11	BLDG 10	149.12	190.40	187.18	2.1600	CIRCULAR	12.000	0.0120	0.00	0 00:00	0.00		5.67	0.00	0.00	Calculated
BLDG 10	PDMH 300	83.61	187.18	186.76	0.5000	CIRCULAR	12.000	0.0120	0.00	0 00:00	0.00		2.73	0.00	0.00	Calculated
COURTYARD 2	PDMH 300	25.94	186.89	186.76	0.5000	CIRCULAR	12.000	0.0120	0.00	0 00:00	0.00		2.73	0.00	0.00	Calculated
PDMH 5	PDMH 4	198.00	187.01	186.61	0.2000	CIRCULAR	24.000	0.0120	5.17	0 00:07	3.55	0.93	10.96	0.47	0.96	Calculated
PDMH 4	PDMH 3	73.63	186.61	186.46	0.2000	CIRCULAR	24.000	0.0120	6.91	0 00:07	3.71	0.33	10.96	0.63	1.15	Calculated

*Courtyard 1 pipe has been modeled with a total curve number of 0.9 and will be reduced upon final design to ensure pipe remains under capacity

MADEP Calculations

Allen & Major Associates, Inc.			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	SMF
Project	*JLB Billerica*		Chk'd	PLC
Location	1&2 Federal Street, Billerica		Apprv'd	
Date	October 29. 2025			
Revised				

Stormwater Recharge/Water Quality Volume Table

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft^3, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft^3*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

					Recharge Required			*Water Quality Volume Required*	
Watershed (Pond 1)	**Area (Sq. Ft.)**	**Landscaped**	**Impervious Area (Square Feet)**		*F Avg. (Inches)*	*Impervious Area (Feet)*	*Rv (ft^3)*	D_{WQ} *(Inch)*	A_{WQ}
			HSG A (F=.6)	**HSG D (F=.1)**					
P-1	54,939	51,676	0	3,263	0.1	3,263	27	1.0	272
P-2	64,512	64,512	0	0	0.0	0	0	1.0	0
P-2.1	2,613	348	0	2,265	0.1	2,265	19	1.0	189
P-2.2	13,809	2,875	0	10,934	0.1	10,934	91	1.0	911
P-2.3	9,322	2,483	0	6,839	0.1	6,839	57	1.0	570
P-2.4	7,492	958	0	6,534	0.1	6,534	54	1.0	545
P-2.5	16,857	4,922	0	11,935	0.1	11,935	99	1.0	995
P-2.6	10,629	2,309	0	8,320	0.1	8,320	69	1.0	693
P-2.7	5,750	1,307	0	4,443	0.1	4,443	37	1.0	370
P-2.8	13,199	1,307	0	11,892	0.1	11,892	99	1.0	991
P-2.9	13,205	1,139	0	12,066	0.1	12,066	101	1.0	1,006
P-2.10	5,794	610	0	5,184	0.1	5,184	43	1.0	432
P-2.11	9,670	2,483	0	7,187	0.1	7,187	60	1.0	599
P-2.12	11,457	5,097	0	6,360	0.1	6,360	53	1.0	530
S-1	7,144	1,438	0	5,706	0.1	5,706	48	1.0	476
S-2	13,459	5,270	0	8,189	0.1	8,189	68	1.0	682
R-1	12,327	0	0	12,327	0.1	12,327	103	Roof Runoff	Roof Runoff
R-2	15,725	0	0	15,725	0.1	15,725	131	Roof Runoff	Roof Runoff
R-3	33,759	7,971	0	25,788	0.1	25,788	215	Roof Runoff	Roof Runoff
R-4	5,140	0	0	5,140	0.1	5,140	43	Roof Runoff	Roof Runoff
R-5	8,146	0	0	8,146	0.1	8,146	68	Roof Runoff	Roof Runoff
R-6	4,792	0	0	4,792	0.1	4,792	40	Roof Runoff	Roof Runoff
P-3	35,109	3,833	0	31,276	0.1	31,276	261	1.0	2,606
P-4	30,751	4,139	0	26,612	0.1	26,612	222	1.0	2,218
P-5	30,537	5,035	0	25,502	0.1	25,502	213	1.0	2,125
P-6	71,076	30,357	0	40,719	0.1	40,719	339	1.0	3,393
P-7	86,176	23,468	0	62,708	0.1	62,708	523	1.0	5,226
Total	**593,389**	**223,537**	**0**	**369,852**		**369,852**	**3,082**		**24,828**

Allen & Major Associates, Inc.			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	SMF
Project	*JLB Billerica*		Chk'd	PLC
Location	1&2 Federal Street, Billerica		Apprv'd	
Date	October 29. 2025			

Stormwater Recharge Summary

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft^3, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

	Required (cf)	***Provided (cf)***	
ARv =	***3,082***	***7,147***	***Infiltration Chamber System***
ARv =	***3,082***	***7,147***	***Total***

Water Quality Volume

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft^3*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***3,902***	***See Note***	***Water Quality Unit (P-2, P-2.1, P-2.2, P-2.3, P-2, P-2.4, P-2.5, P-2.6)***
A_{WQ} =	***3,902***	***See Note***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***370***	***1,886***	***Sub-Surface Structure #1 (P-2.7)***
A_{WQ} =	***370***	***1,886***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***991***	***3,673***	***Sub-Surface Structure #2 (P-2.8)***
A_{WQ} =	***991***	***3,673***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***1,006***	***1,588***	***Sub-Surface Structure #3 (P-2.9)***
A_{WQ} =	***1,006***	***1,588***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***4,167***	***See Note***	***Water Quality Unit (P-2.10, P-2.11, P-2.12, P-3)***
A_{WQ} =	***4,167***	***See Note***	***Total***

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***3,393***	***See Note***	***Water Quality Unit (P-6)***
A_{WQ} =	***3,393***	***See Note***	***Total***

Allen & Major Associates, Inc.			Computation Sheet	
Title	***MA DEP Standard Calculations***		By	SMF
Project	*JLB Billerica*		Chk'd	PLC
Location	1&2 Federal Street, Billerica		Apprv'd	
Date	October 29. 2025			

	Required (cf)	***Provided (cf)***	
A_{WQ} =	***5,226***	***See Note***	***Water Quality Unit (P-7)***
A_{WQ} =	***5,226***	***See Note***	***Total***

Water quality volume for the following watershed areas, P-2, P-2.1, P-2.2, P-2.3, P-2, P-2.4, P-2.5, P-2.6, P-2.10, P-2.11, P-2.12, P-3, P-6, and P-7 have been converted to a water quality flow for treatment handling through a Contech Water Quality separator (Proprietary Treatment Device) in accordance with the Mass Stormwater Handbook. Please refer to the water quality calculations for the proprietary devices as included in the appendix

Draindown Within 72 Hours

$Time_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Subsurface Infiltration Systems (HSG D)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	5,977
Infiltration Volume (ft^3) =	7,147
$Time_{drawdown}$ (Hours)=	14.07

TSS Calculations

TSS Removal Calculation Worksheet – Sub-Surface Infiltration Structures Prior to Infiltration				
A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (B*C)	Remaining Load (C-D)
Proprietary Separator	50%*	1.00	0.50	0.50
			Total TSS Removal prior to infiltration	**50.0% (44% Required)**

*Proprietary TSS removal rates have been capped at 50% though manufacturer studies report more effectiveness.

TSS Removal Calculation Worksheet – Sub-Surface Structures (SC-310)				
A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (B*C)	Remaining Load (C-D)
Proprietary Separator	50%*	1.00	0.50	0.50
Sub-Surface infiltration	80%	0.50	0.40	0.10
			Total TSS Removal	**90%(80% Required)**

*Proprietary TSS removal rates have been capped at 50% though manufacturer studies report more effectiveness.

-Sub catchments P-2.7, P-2.8, P-2.9

-Total area draining to catch basins= 32,154 s.f.

TSS Removal Calculation Worksheet – Water Quality Unit				
A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	25%	1.00	0.25	0.75
Proprietary Separator	50%*	.75	0.38	0.38
			Total TSS Removal	**63%(80% Required)**

*Proprietary TSS removal rates have been capped at 50% though manufacturer studies report more effectiveness.

-Sub catchments (P-2, P-2.1, P-2.2, P-2.3, P-2, P-2.4, P-2.5, P-2.6), (P-2.10, P-2.11, P-2.12), (P-3), (P-6)

-Total area draining to catch basins = 141,356 s.f.

To evaluate the Total Suspended Solids (TSS) removal efficiency of the stormwater management system, a weighted average calculation was performed in accordance with the methodology outlined in the Massachusetts Stormwater Handbook, Volume 3, Chapter 1. The weighted average accounts for the proportional flow contribution and individual TSS removal efficiencies of each treatment practice contributing to the discharge at Study Point 2L (flow to Bordering Vegetated Wetlands). The following equation was used to determine the composite TSS removal efficiency:

Mass stormwater handbook volume 3 chapter 1.

$$Weighted\ Average\,\% = \frac{\left(Area_1\right)\left(TSS_1\%\right) + \left(Area_2\right)\left(TSS_2\%\right) + \left(Area_n\right)\left(TSS_n\%\right)\right)}{\left(Area_1 + Area_2 + Area_n\right)}$$

Equation (1)

Applying this equation to the site's contributing drainage areas yields the following:

$$68\% = \frac{(32{,}154 \times 90\%) + (141{,}356 \times 63\%)}{32{,}154 + 141{,}356}$$

TSS Removal Calculation Worksheet – Water Quality Unit – Existing Detention Basin				
A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (B*C)	Remaining Load (C-D)
Deep Sump and Hooded Catch Basin	25%	1.00	0.25	0.75
Proprietary Separator	50%*	.75	0.38	0.38
Existing Detention Basin	80%	.38	0.30	0.08
			Total TSS Removal	**93%(80% Required)**

*Proprietary TSS removal rates have been capped at 50% though manufacturer studies report more effectiveness.

-Sub catchments P-7

Phosphorus Loading Calculations

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	3490-03	
Project Description:	JLB Billerica	
Calculated By:	SMF	Date: 10/29/2025
Checked By:	PLC	Date: 10/29/2025

ESTIMATE FOR PHOSPHORUS REMOVAL

Existing Condition Phosphorus Loading

Site Use	Phosphorus Load by Land Use (lbs/ac/yr)		Area (Acres)	Existing Phosphorus Load (lbs/yr)
Forest	0.13		3.15	**0.41**
Commercial	1.78		3.91	**6.96**
Open Space Soil Type D	0.37		0.78	**0.29**
		Total	**7.84**	**7.66**

Proposed Condition Phosphorus Loading

Site Use	Phosphorus Load by Land Use (lbs/ac/yr)		Area (Acres)	Proposed Phosphorus Load (lbs/yr)
Forest	0.13		2.51	**0.33**
Open Space Soil Type D	0.37		1.42	**0.53**
High Density Residential	2.32		3.91	**9.07**
		Total	**7.84**	**9.92**

Phosphorus Reduction Requirement

Phosphorus Reduction Requirement =	Proposed Phosphorus Load x 50%*			
=	9.92	x	0.5	
=	**4.96**	lbs/year		
Target Phosphorus Load	9.92	-	4.96	
(Post Construction) =	**4.96**	**(Target Phosphorus Load)**		

*Table F-2, Appendix F, MA MS4 General Permit

Proposed Condition Phosphorus Loading Reduction

BMP	BMP (Appendix F Category)	Total Phosphorous Load to BMP (lbs/yr)***	BMP Removal %**	Phosphorus Removed by BMPs (lbs/year)
Subsurface Structures	Subsurface Structures	2.37	85%	**2.02**
Note: See following pages for phosphorus removal calculations			**Total**	**2.02**

Proposed Load before reduction		**-**	**Loading Reduction**	**=Actual Constructed Phosphorus Load**	
Actual Constructed Phosphorus Load	9.92	-	2.02	**(Target Phosphorus Load)**	
Actual Constructed Phosphorus Load	**14.04**	**lb/yr**	**compared to ---------->**	4.96	

Percent Phosphorus Removed =	Loading Reduction / Proposed Load before reduction x 100		
Percent Phosphorus Removed =	**20%**	**<**	50%

Phosphorus Calculations Per BMP

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)	Area to Sys #1	44,512	S.F.
				Volume Treated	7,147	C.F.
Subsurface Structures			(per BMP)	Depth of runoff treated	**1.9**	IN.
High Density Residential	2.32	1.02	**2.37**	**BMP Removal %****	85%	
	total	**1.02**	**2.37**	**Table 3-11, Appendix F, MA MS4 General Permit		

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	3490-03	
Project Description:	Multi-Family Development	
Calculated By:	SMF	Date: 10-29-2025
Checked By:	PLC	Date: 10-29-2025

Table 3- 17: Infiltration Basin (1.02 in/hr) SCM Performance Table

Surface Infiltration (1.02 in/hr) SCM Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
SCM Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	24.5%	42.0%	65.6%	79.4%	86.8%	91.3%	96.2%	98.1%
Cumulative Phosphorus Load Reduction	41%	60%	81%	90%	94%	97%	99%	100%
Cumulative Nitrogen Load Reduction	59%	77%	92%	96%	98%	100%	100%	100%

Figure 3-12: SCM Performance Curve: Surface Infiltration (Soil infiltration rate = 1.02 in/hr)

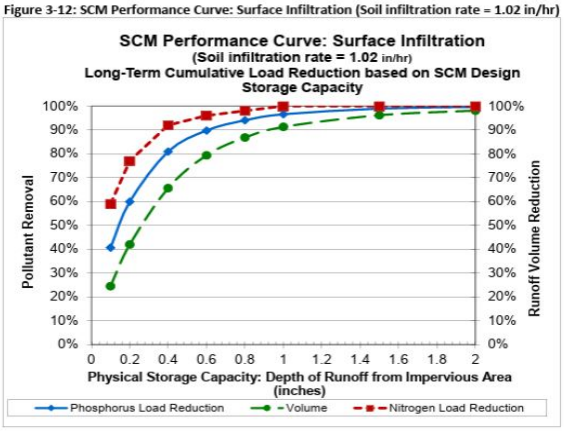


Table 3-1: Average annual distinct phosphorus (P) load export rates for use in estimating P load reduction credits in the MA MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs./acre/year	P Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (OPEN)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5
*Developed Land Pervious (DevPERV) – HSG A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV) – HSG B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) – HSG C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	0.29	0.33
*Developed Land Pervious (DevPERV) – HSG D	Pervious	0.37	0.41

Capture Area Adjustment

The Recharge Volume is as provided in Standard 3 of the Project Drainage Report. Not all runoff is directed towards a subsurface recharge device. In order to further comply with standard 3, a Capture Area Adjustment is required. The intent is for compliance to the maximum extent practicable given the redevelopment of the property.

Capture Area Adjustment is outlined in Volume 3, Chapter 1, Documenting Compliance with the Massachusetts Stormwater Management Standards.

Watershed Catchment ID	Watershed Area (s.f.)	Imperviousness (%)	Impervious area (s.f.)	Required Runoff SCS Volume (D Soils)	Required Recharge Volume (c.f.)
2.1	2588	87.23	2257.51	0.10	18.81
2.1	5771	89.76	5180.05	0.10	43.17
2.11	9666	74.33	7184.74	0.10	59.87
2.12	11539	55.13	6361.45	0.10	53.01
2.2	13816	79.28	10953.32	0.10	91.28
2.3	9287	73.49	6825.02	0.10	56.88
2.4	7486	87.21	6528.54	0.10	54.40
2.5	16961	70.41	11942.24	0.10	99.52
2.6	10646	78.25	8330.50	0.10	69.42
2.7	5773	76.97	4443.48	0.10	37.03
2.8	13200	90.13	11897.16	0.10	99.14
2.9	13204	91.38	12065.82	0.10	100.55
r-1	12335	100.00	12335.00	0.10	102.79
r-2	15710	100.00	15710.00	0.10	130.92
r-3	33729	76.43	25779.07	0.10	214.83
r-4	5126	100.00	5126.00	0.10	42.72
r-5	8150	100.00	8150.00	0.10	67.92
r-6	4793	100.00	4793.00	0.10	39.94
			165,862.90		1,382.19

*Watershed IDs based on HydroCAD data

Total Impervious drainage area from above = 165,862.90 s.f.
Total required Recharge Volume = 1,382.19 c.f.

1) Calculate the *Required Recharge Volume* based on total site impervious cover and underlying soil classification and size the infiltration BMP using the "*Static*" Method or one of the "*Dynamic*" Methods

1,382.19 c.f.

2) Calculate the site's impervious area that drains to proposed recharge facilities.

40,741.45 s.f. (based on watersheds 2.7, 2.8, 2.9, and R-1)

3) Divide the total site impervious area by the impervious area draining to the proposed recharge facilities.

165,862.90 s.f. / 40,741.45 s.f. = 4.07

4) Multiply the resulting quotient from Step 3 by the original *Required Recharge Volume* calculated under Step 1 to determine the adjusted minimum storage volume needed to meet the recharge volume requirement. The "*Static*" Method or either of the *Dynamic* Methods may be used to determine the storage volume.

1,382.19 * 4.07 = 5,627 c.f. of minimum required storage volume

Provided storage volume: **Subsurface system 1 = 1,588 c.f.**
Subsurface system 2 = 3,673 c.f.
Subsurface system 3 = 1,886 c.f.
Total static volume = 7,147 c.f. (> 5,627 c.f.)

Excess of the adjusted recharge volume storage is provided. A&M notes that the impervious capture area is less than 65% of the total impervious area onsite and that recharge is provided to the maximum extent practicable. Recharge volume is provided in excess of the two-year storm volume in these areas.