

STORMWATER MEMORANDUM

**STORAGE FIVE CRANSTON
1 KENNEY DRIVE & O SHARPE STREET
CRANSTON, RHODE ISLAND 02920**

Applicant:

**STORAGE FIVE CRANSTON, LLC.
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Prepared By:

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CEC Project 342-782

SEPTEMBER 2024



Civil & Environmental Consultants, Inc.

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1.0 PROJECT NARRATIVE

1.1 INTRODUCTION

On behalf of Storage Five Development (the “Applicant”), Civil & Environmental Consultants, Inc. (CEC) has prepared this stormwater memorandum and analysis to demonstrate compliance with the Rhode Island Department of Environmental Management (RIDEM) Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8) and City of Cranston Requirements for redevelopment projects.

The Applicant is proposing to redevelop an existing portion of impervious area within the subject parcel, Parcel 13-50-01, as identified by the City of Cranston Assessor’s office, located at 1 Kenney Drive in Cranston, Rhode Island (the “Site”). It’s important to note that the existing Site is comprised of three parcels (13-5-00, 13-50-01, 13-67-00), which are proposed to be subdivided into two parcels, Parcel A and Parcel B where the proposed redevelopment occurs on proposed Parcel A (the subject parcel). While the subject parcel totals approximately 6.67 acres, the proposed limit of disturbance is only approximately 1.40 acres. The proposed work includes the demolition of the existing southeast surface parking area and repaving to accommodate the construction of two self-storage facilities totaling $\pm 13,625$ GSF along with associated site, landscape, and drainage improvements (the “Project”). The project results in a net increase of pervious area and a net decrease of impervious area, providing an overall improvement to the existing site condition in addition to proposed drainage improvements to satisfy RIDEM’s redevelopment criteria.

This Stormwater Memorandum describes proposed design of the Site’s stormwater management system as depicted in the Development Plan Review Plan Set, prepared by CEC, dated September 25, 2024, provided under separate cover.

1.2 EXISTING CONDITIONS

The Site is located at 1 Kenney Drive in Cranston, Rhode Island, bounded to the west by Pontiac Ave, to the north by Kenney Drive, to the east by existing industrial property, and to the south existing industrial property. The site contains an existing 1 story masonry building that was previously home to the “Swarovski” offices along with associated parking, sidewalk, and landscape areas. See Figure 1 for a Site Locus Map and Figure 2 for an Aerial Map.

The proposed limit of work exists entirely within existing impervious area that currently consists of paved parking area proximate to the existing loading docks. Existing topography on the Site ranges from elevation 76.8 feet (NAVD 88) at the northern corner of the parking lot and elevation 69.5 feet at the southern end of the parking lot. Stormwater from the Site flows overland to existing

catch basins prior to connecting into an existing drainage network and ultimately discharging to an existing stormwater basin located at the southwestern corner of the site.

The Site is located within Zone X (unmapped) as shown on the Federal Emergency Agency (FEMA) Flood Insurance Rate Map (FIRM) for the City of Cranston, Map # 44007C0427H, effective October 2, 2015.

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the Site is classified as Urban Land (#603) – Urban land, wet substratum, 0 to 3 percent slopes. Urban land refers to land that has been excavated and filled. The Urban Land soil classification does not have an assigned hydrological soil group. Due to the presence of fill material and general impervious nature of the site, exfiltration was not modeled in the assessed stormwater design.

1.3 PROPOSED PROJECT

The proposed project includes the construction of two self-storage facilities totaling $\pm 13,625$ GSF along with associated site, landscape, and drainage improvements (the “Project”). As the project is proposed entirely within existing impervious area, and includes additional landscape islands, the project results in a net increase of pervious area and a net decrease of impervious area, providing an overall improvement to the existing site condition in addition to proposed drainage improvements to satisfy RIDEM’s redevelopment criteria.

In the proposed condition, 98% of the project area is impervious, consisting of paved parking area and building footprint. This is a net reduction over the existing condition, with 2% of the project area now consisting of grassed/landscape area. The overall drainage pattern will be maintained in the proposed condition, as the majority of runoff will flow overland to an existing catch basin at the southeast corner of the site, connecting into the existing drainage system and ultimately discharging to an existing drainage basin. The new roof area associated with the proposed self-storage buildings will connect to a proposed subsurface infiltration system before tying into the existing southeast catch basin and ultimately connecting to the rest of the existing drainage system. The subsurface infiltration system has been sized to accommodate the tributary roof area in the 100-year storm and is sized to provide the required water quality and recharge requirements outlined in Section 3.2.6 of the RISDISM Redevelopment Criteria guidance. The site qualifies as a redevelopment as it involves construction, alteration, or improvement totaling more than 10,000 SF of existing impervious area. The site also qualifies for reduced water quality and recharge requirements as in its existing condition, the site is greater than 40% impervious. The assessed stormwater treatment area is based off of 50% treatment for disturbed existing impervious area, as the proposed work exists entirely within existing impervious area, and subtracts out the net increase in pervious area, as outlined in Section 3.2.6 of the RISDISM Redevelopment Criteria guidance.

2.0 STORMWATER MANAGEMENT PLAN

2.1 DESCRIPTION OF STANDARDS

Consistent with the Rhode Island Department of Environmental Management (RIDEM) Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8), we have outlined the Project's general compliance with the required standards.

Standard 1: LID Planning & Design Strategies – Low impact design (LID) and design strategies must be used to the maximum extent practicable.

Standard met – the proposed subsurface infiltration system and proposed reduction in net impervious area result in reduction of peak rates and volumes, an increase in recharge, and an increase in water quality treatment.

Standard 2: Groundwater Recharge – Stormwater must be recharged within the same sub-watershed to maintain base flow at pre-development recharge levels to the maximum extent practicable.

Standard met – Groundwater recharge will be provided onsite within the same sub-watershed through the proposed subsurface infiltration system. The infiltration system was sized to provide recharge consistent with Section 3.2.6 of the RISDISM Redevelopment Criteria guidance. The required recharge (Re_v) associated with the proposed project was assessed to be 218 cubic feet, assuming HSG D soils, as the site is currently mapped as urban fill. The assessed provided recharge is 1,274 cubic feet, well in excess of the required. Refer to Appendix B for the WQv calculation spreadsheet and Groundwater Recharge Spreadsheet.

Standard 3: Water Quality – Stormwater Runoff from site must be treated prior to discharge.

Standard partially met – The existing drainage pattern is being maintained in the proposed condition and water quality volume is provided to the extent practicable. Catch basins are utilized in the existing and proposed condition to provide pre-treatment for TSS associated with tributary impervious area. An existing dry well is utilized in the existing and proposed condition to provide water quality treatment. There is an existing infiltration basin in southwest site that the existing drainage system discharges to which also provides water quality treatment in the existing and proposed condition. Additionally, the project includes a proposed subsurface infiltration system to provide recharge and water quality treatment associated with the clean roof runoff of both proposed self-storage buildings. The total provided water quality volume by the subsurface infiltration system is 1,274 CF. If the required water quality volume is calculated for the first half-inch of runoff, the required Water Quality Volume (WQv) is 1,131 CF; the provided WQv is greater than required.

However, if WQv is required to be assessed for the first full inch of runoff, the required WQv is 2,262 CF and the provided WQv is not met, however, this does not take into consideration the water quality treatment provided by the existing drywell maintained within the redevelopment area nor does it consider water quality treatment provided by the existing infiltration basin receiving flow from the redevelopment area in both the existing and proposed conditions. The proposed stormwater design utilizes the entire new roof area for recharge and water quality treatment. The remaining impervious area considered is repaving existing impervious area, generally consistent with site maintenance, with improvements made to reduce existing impervious area by proposing new pervious area through proposed landscape islands. Water Quality treatment has been provided to the extent practicable, in excess of the first half-inch of runoff, and additional water quality is being provided by the existing drywell and existing infiltration basin to which the site drainage is tributary. The RIDEM Stormwater Design and Installation Standards Manual requires the minimum WQv value of 0.2” over the entire disturbed area, which the proposed project exceeds as it provides WQv value in excess of 0.5”. See Appendix C4 for calculations.

Standard 4: Conveyance and Natural Channel Protection – Provide adequate stormwater conveyance systems.

Standard met – the proposed project maintains the existing drainage pattern and no additional area is tributary to the existing site drainage system in the proposed condition. The proposed reduction in impervious area and the inclusion of the proposed infiltration system results in a reduction of peak flows and volumes. As such, the capacity of the existing conveyance system is maintained, if not slightly improved, in the proposed condition.

Standard 5: Overbank Flood Protection - Peak rate attenuation from pre- to post-development in the 10- and 100-year 24-hr storms.

Standard met – Peak rates are maintained from the pre- to post-development condition in the 10- and 100-year 24-hr storms based on NRCC rainfall data per the Rhode Island Stormwater Management, Design and Installation Rules. See summary calculation in Section 3.3 below.

Standard 6: Redevelopment and Infill Projects

Standard met - The existing site has greater than 40% impervious coverage and the proposed development will result in a decrease in impervious area, and as such qualifies as a redevelopment.

Standard 7: Pollution Prevention

Standard met – The site has been designed to minimize impact on stormwater runoff. Soil erosion and pollution control measures including a crushed stone construction entrance, inlet protection, and silt sock are proposed during construction. Please see Soil Erosion and Sediment Control Plan provided in the Development Review Plan Set under separate cover and Operations and Maintenance Plans provided in Appendix C.

Standard 8: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

Standard not applicable - The proposed project and self-storage use is not a Land Use with Higher Potential Pollutant Loads, as defined in Section 8.14.C of the Rhode Island Stormwater Management, Design, and Installation Rules.

Standard 9: Illicit Discharges

Standard met - No illicit discharges are proposed.

Standard 10: Construction Erosion and Sedimentation Control

Standard met - The site has been designed to minimize impact on stormwater runoff. Soil erosion and pollution control measures including a crushed stone construction entrance, inlet protection, and silt sock are proposed during construction. Please see Soil Erosion and Sediment Control Plan provided in the Development Review Plan Set under separate cover.

Standard 11: Stormwater Management System Operation and Maintenance

Standard met - A stormwater management system Operation and Maintenance (O&M) Plan has been prepared for this project and is included in Appendix C of this report. The O&M Plan includes specific requirements for the long-term function of each component of the proposed system, in order to ensure compliance with these minimum standards. The O&M Plan indicates the responsible party (the property owner) and provides an estimated annual budget. The O&M for this site will be privately financed by the owner.

2.2 DESCRIPTION OF RUNOFF CONTROLS

The stormwater management improvements consist of a net decrease in impervious area, the proposed subsurface infiltration system to manage runoff from the new roof area, and the use of existing catch basins to provide TSS treatment consistent with the existing condition. These components attenuate runoff discharge peaks, minimize erosion, minimize the transport of

sediments, improve water quality, provide recharge, and prevent impact to downstream resource areas to the extent practicable.

The proposed stormwater management system will use the following specific control measure:

- Subsurface Stormwater Chambers (Cultec Recharger 902HD Chambers): Water Quality for the proposed redevelopment is provided from subsurface stormwater chambers that collect the clean runoff from the 2 building's roof areas, which are located beneath the paved parking and circulation areas. Runoff from the rest of the site is capture into the existing catch basin located at the southern corner of the project. Although infiltration was not used in the calculations, the subsurface chambers will provide stormwater recharge through the infiltration treated runoff from the building's roof areas. Calculations for the provided water quality volume and system drawdown time are provided in Appendix B.

The proposed runoff control is detailed on the Development Plan Set included under separate cover.

2.3 CONSTRUCTION SEQUENCE PLAN

The purpose of the Construction Sequence Plan is to develop a working schedule for the implementation of the proposed stormwater improvements.

Prior to initiating any work, siltation control barriers will be installed along the limit of work. Once the appropriate permits are obtained, the construction project will commence in the following sequence:

1. Install all necessary siltation barriers and inlet protections as shown in the design drawings.
2. Perform demolition of existing pavement and remove existing site features shown on the design drawings.
3. Perform excavation for building foundation areas and proposed drainage improvements.
4. Place clean fill/pavement base materials and install pavement base and curbing.
5. Construct buildings.
6. Install proposed final landscaping (*if applicable*).
7. Remove existing erosion control measures.

All construction water will be collected and treated in accordance with the Erosion and Sediment Control Plan included in Appendix C.

3.0 STORMWATER ANALYSIS

3.1 METHOD OF ANALYSIS

A hydrologic analysis has been performed for the Site comparing existing conditions and post-development conditions using a software program developed by HydroCAD Software Solutions LLC. This program analyzes site hydrology by the graphic peak discharge method documented in Technical Release No. 20 and Technical Release No. 55 published by the United States Department of Agriculture (USDA) Soil Conservation Service.

The following variables were developed for the contributing watersheds (drainage areas) in order to complete the analysis:

- **Rainfall Depth:** A hydrologic analysis was performed for the 24-hour 2-year, 10-year, 25-year, and 100-year, Type III storm events (3.3, 4.9, 6.1, and 8.7 inches respectively) for each drainage area. The rainfall depths for the study area were obtained from the Northeast Regional Climate Center (NRCC) for Providence County, in which the project parcel resides.
- **Runoff Curve Number (RCN):** The RCN is a hydrologic characteristic that contributes to the peak rate of runoff and volume from a given storm event. It is dependent upon soil conditions and land use. Generally, higher curve numbers are associated with less pervious soils and, hence, greater amounts of runoff. As previously noted, based on the NRCS Web Soil Survey Report, Hydrologic Soil Group (HSG) D was assumed in determining RCNs due to the presence of urban fill.
- **Time of Concentration:** The time of concentration is defined as the time it takes runoff to travel from the hydraulically most distant part of the watershed to the downstream point of interest. This parameter is dependent on the characteristics of the ground surface and condition of the travel path. Times of concentration were calculated for the various sub catchments using the HydroCAD program, with a minimum time of concentration of six (6.0) minutes used in accordance with the protocol outlined in Technical Release No. 55.

3.2 DRAINAGE AREAS

Drainage areas delineating the pre- and post-development conditions were determined from existing and proposed topography respectively. Brief descriptions of the existing conditions and proposed condition drainage areas are as follows:

- **Existing Condition:** The project is divided into only one (1) drainage area as stormwater runoff from the disturbed impervious area within the project area ultimately drains to one (1) design point, the existing stormwater system (Design Point A). A1-EX captures the entirety of the redevelopment area discharging directly to the existing stormwater system via existing catch basins. Refer to Figure HYD-EX for the existing conditions drainage areas.

TABLE 3.1 PRE-DEVELOPMENT CONDITIONS				
Drainage Area	Design Point	Area (sf.)	Curve Number	Time of Concentration (minutes)
A1-EX	A	56,700	98	6.0

- **Proposed Conditions:** The post-development condition was delineated into two (2) drainage areas ultimately conveying to one (1) design point, the existing stormwater system (Design Point A).
 - A1-PR is inclusive of non-roof area, overland flow from the redevelopment discharging to the existing stormwater system via the existing catch basin in southeast site.
 - A2-PR is inclusive of proposed roof area associated with the proposed self-storage buildings which connect to the proposed subsurface stormwater chambers before ultimately connecting to the existing stormwater system via the existing catch basin.
 - Refer to Figure HYD-PR for the proposed conditions drainage areas.

TABLE 3.2 POST-DEVELOPMENT CONDITIONS				
Drainage Area	Design Point	Area (sf.)	Curve Number	Time of Concentration (minutes)
A1-PR	A	43,075	97	6.0
A2-PR		13,625	98	6.0

3.3 RESULTS OF ANALYSIS

A stormwater analysis was performed for the 24-hour 2-, 10-, 25-, and 100-year storm events to determine that there will be no increase in stormwater runoff offsite once the proposed construction is complete and the stormwater control structures are in place. Detailed calculations are attached in Appendix B. A summary of the peak runoff rates is provided in Table 3.3 detailing that there has been no increase in peak rates from pre- to post-development condition.

TABLE 3.3								
PROJECT STORMWATER RUNOFF RATES								
	Peak Runoff Rate (cfs)							
	2-Year		10-Year		25-Year		100-Year	
	Ex.	Prop.	Ex.	Prop.	Ex.	Prop.	Ex.	Prop.
A	4.1	4.0	6.1	6.1	7.6	7.6	10.9	10.9

cfs = cubic feet per second

4.0 CONCLUSION

The proposed improvements have been designed to minimize impacts of the proposed site redevelopment by meeting or reducing peak stormwater runoff rates in the 2-, 10-, 25-, and 100-yr storms and increasing the quality of the stormwater leaving the site by the installation of BMP's including the proposed subsurface infiltration system. The proposed subsurface infiltration system infiltrates, recharges, and attenuates roof runoff that under the existing condition was impervious parking area that discharged overland to the existing drainage system, creating an improvement over the existing condition. The proposed work also results in a net increase in pervious area and net decrease in impervious area from the pre- to post-development condition.

FIGURES

Figure 1 – Site Locus

Figure 2 – Aerial Exhibit

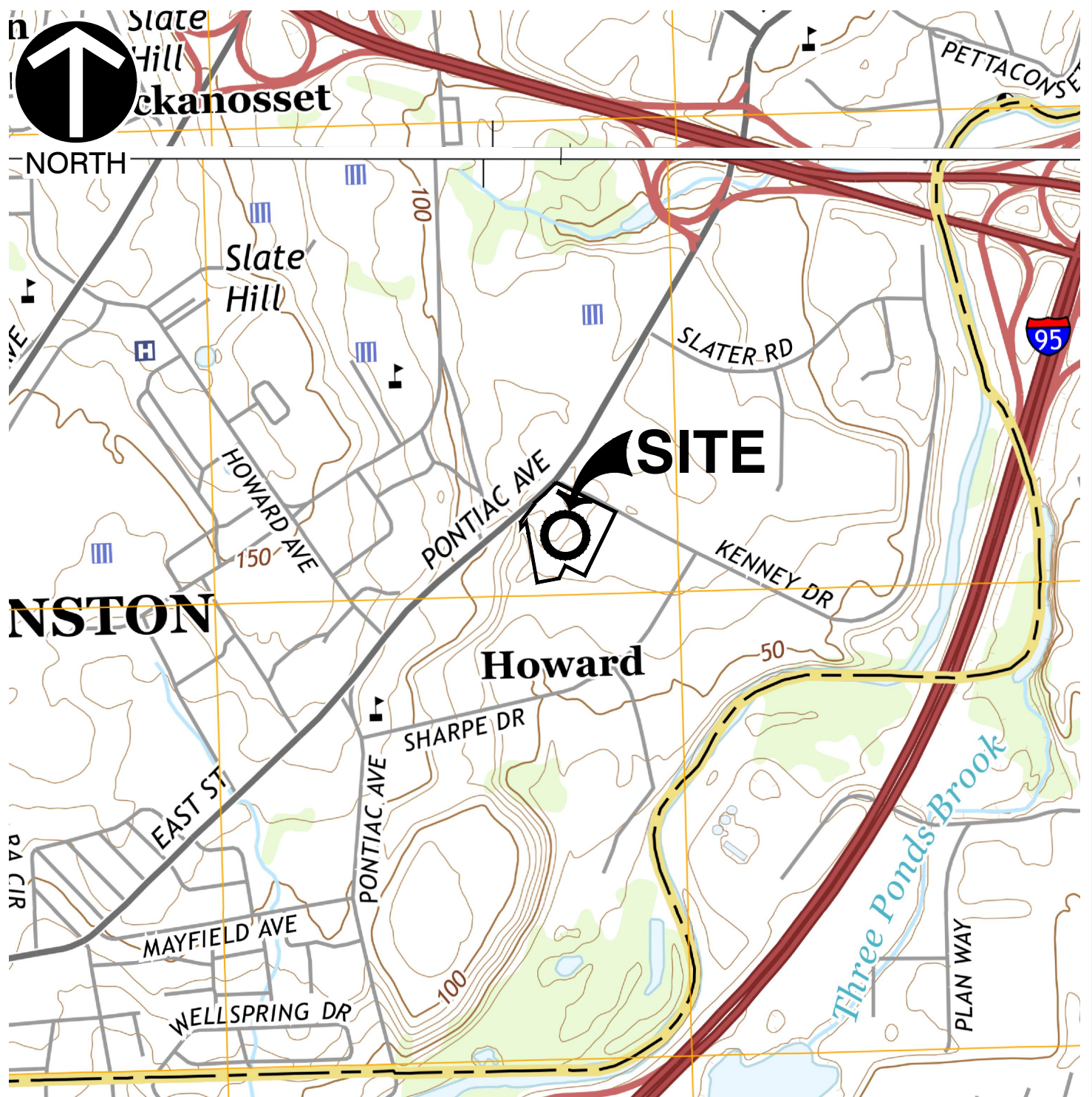
Figure 3 – FEMA FIRMette

Figure 4 – NHESP Map

Figure HYD-EX – Existing Conditions Drainage Area Map

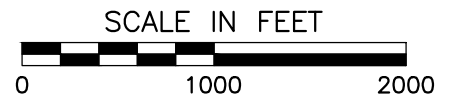
Figure HYD-PR – Proposed Conditions Drainage Area Map

P:\340-000\342-782-CADD\DWG\SP01\342782-CV01-SP01-Site Locus.dwg[FIGURE 1] LS:(9/20/2024 - cvandenbergh) - LP: 9/23/2024 8:28 AM



REFERENCE

1. U.S.G.S. 7.5' TOPOGRAPHIC MAP, 20150709, 20150707, QUADRANGLE, RI DATED: 2015, ACCESSED: SEPTEMBER 2024.



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1 KENNEY DRIVE
CRANSTON, RHODE ISLAND

USGS LOCUS

DRAWN BY:	CJV	CHECKED BY:	CJV	APPROVED BY:	MB	FIGURE NO.:
DATE:	SEPTEMBER 2024	DWG SCALE:	1"=500'	PROJECT NO:	342-782	1

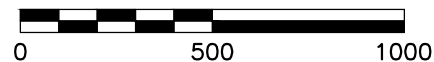
P:\340-000\342-782\ -CADD\DWG\SP01-Aerial Exhibit.dwg{FIGURE 2} LS:(9/20/2024 - cvandenbergh) - LP: 9/23/2024 8:30 AM



REFERENCE

1. ORTHOGRAPHIC AERIAL IMAGERY AND MAPS ARE BASED ON GIS DATA OBTAINED FROM RIGIS GIS DATA OBTAINED FROM RIGIS PROVIDED BY THE RHODE ISLAND GEOGRAPHIC INFORMATION SYSTEM ACCESSED: SEPTEMBER 2024. ACCESSED: SEPTEMBER 2024.

SCALE IN FEET



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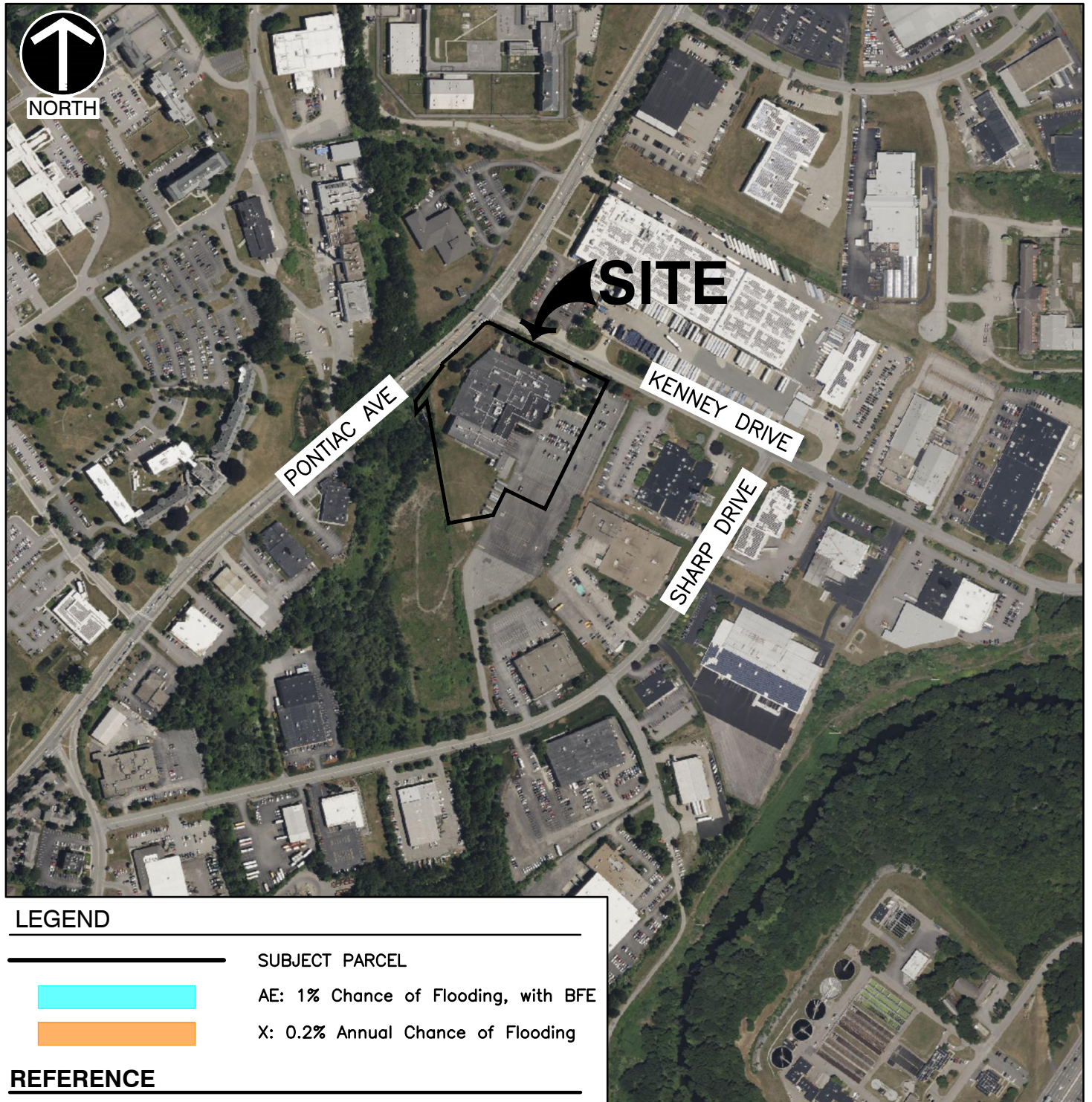
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AERIAL EXHIBIT

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DATE:	SEPTEMBER 2024	DWG SCALE:	1"=500'	PROJECT NO:	342-782	2

P:\340-000\342-782\ -CADD\DWG\SP01\342782-CV01-SP01-GIS-FEMA FIRMette.dwg\FIGURE 3\ LS:(9/20/2024 - cvandenbergh) - LP: 9/23/2024 8:31 AM



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FEMA FLOOD MAP

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DATE:	SEPTEMBER 2024	DWG SCALE:	1"=500'	PROJECT NO:	342-782		

P:\340-000\342-782\ -CADD\DWG\SP01\342782-CV01-SP01-GIS-FEMA FIRMette.dwg\FIGURE 4\ LS(9/20/2024 - cvandenbergh) - LP: 9/23/2024 8:46 AM



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NATURAL HERITAGE MAP

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DATE:	SEPTEMBER 2024	DWG SCALE:	1"=500'	PROJECT NO:	342-782	4



PONTIAC AVENUE
(PUBLIC - VARIABLE WIDTH ROW)

SBDH
FOUND

TELE
BOX

1 STORY
MASONRY BUILDING
"SWAROVSKI"
BFPA=85,608±SF

A1-EX

A

LEGEND



DESIGN POINT



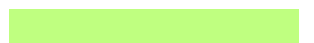
SUBCATCHMENT AREA



SUBCATCHMENT BOUNDARY



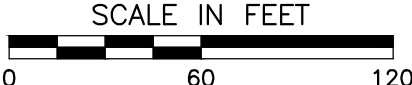
TIME OF CONCENTRATION PATH



VEGETATED AREA



PAVED AREA



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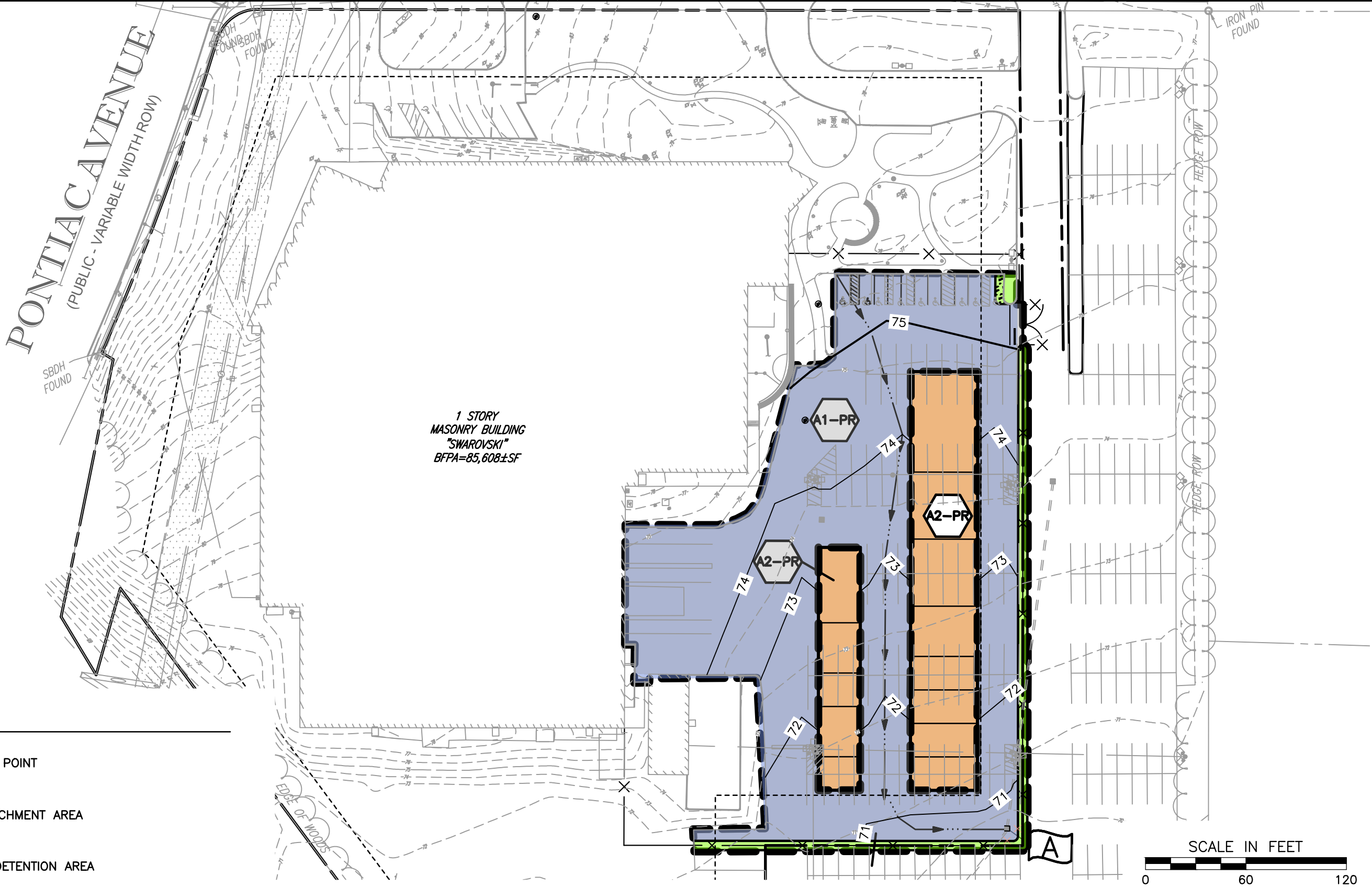
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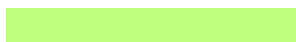
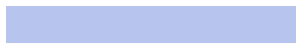

DRAINAGE AREA MAP
EXISTING CONDITIONS

DRAWN BY:	CJV	CHECKED BY:	MB	APPROVED BY:	KPS	FIGURE NO.:	HYD-EX
DATE:	SEPTEMBER 2024	DWG SCALE:	1"=60'	PROJECT NO:	342-782		

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LEGEND

-  DESIGN POINT
-  SUBCATCHMENT AREA
-  POND/DETENTION AREA
-  SUBCATCHMENT BOUNDARY
-  TIME OF CONCENTRATION PATH
-  PROPOSED VEGETATED AREA
-  PROPOSED PAVED AREA
-  PROPOSED ROOF AREA

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DRAINAGE AREA MAP
PROPOSED CONDITIONS

DRAWN BY:	CJV	CHECKED BY:	MB	APPROVED BY:	KPS	FIGURE NO.:
DATE:	SEPTEMBER 2024	DWG SCALE:	1"=60'	PROJECT NO:	342-782	HYD-PR

APPENDIX A

GEOTECHNICAL INFORMATION

NRCS Custom Soil Resource Report

NRCS Custom Soil Resource Report



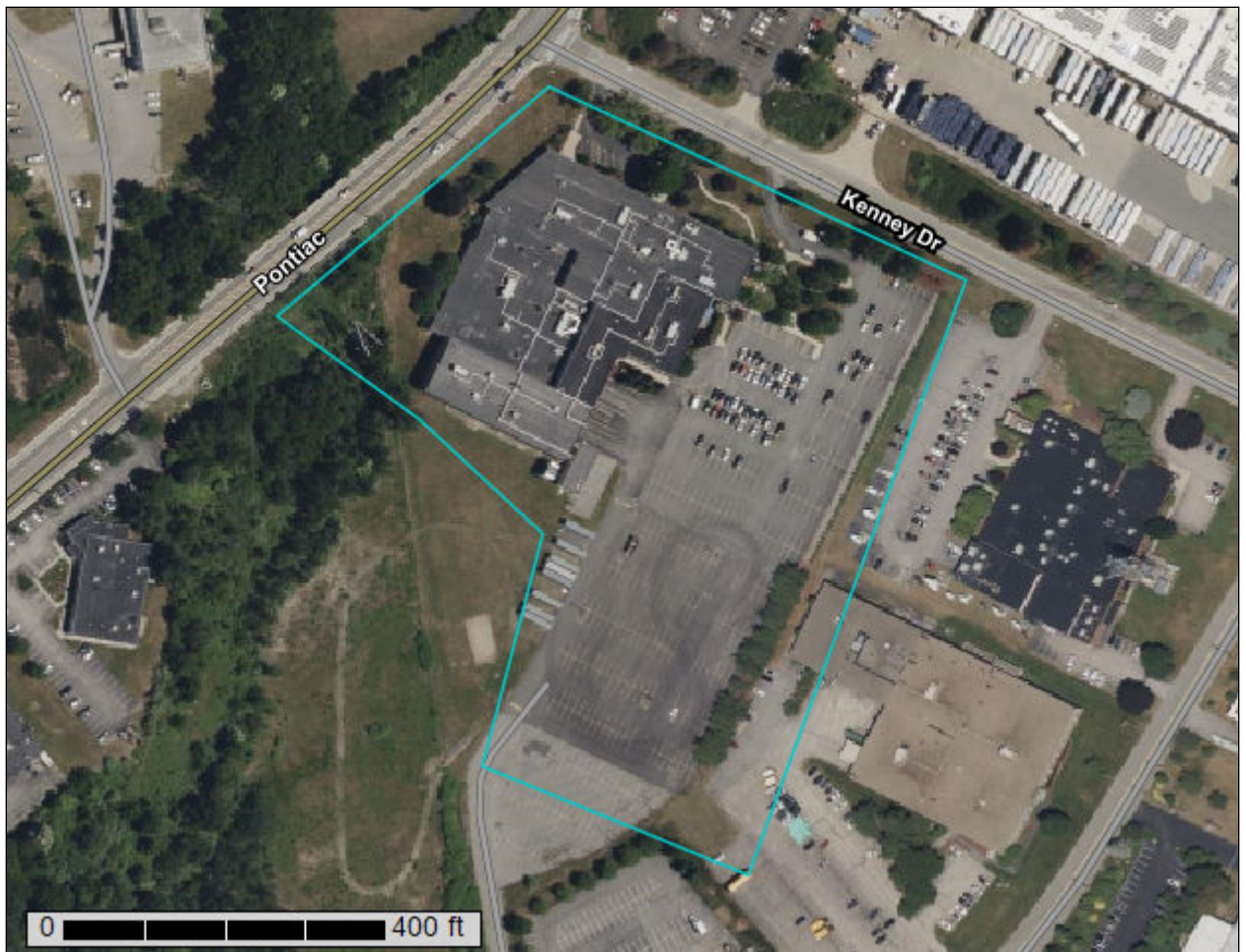
United States
Department of
Agriculture

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 State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties



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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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

Custom Soil Resource Report

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



Custom Soil Resource Report

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 1:12,000.

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: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties

Survey Area Data: Version 23, Sep 8, 2023

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

Date(s) aerial images were photographed: Jun 14, 2022—Jul 1, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

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
UD	Udorthents-Urban land complex	10.0	100.0%
Totals for Area of Interest		10.0	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.

State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties

UD—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 9lxj
Elevation: 0 to 670 feet
Mean annual precipitation: 44 to 50 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 70 percent
Urban land: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Human transported material

Typical profile

A - 0 to 12 inches: sandy loam
C1 - 12 to 25 inches: sandy loam
C2 - 25 to 60 inches: stratified sand to very gravelly coarse sand

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 42 to 54 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Hydrologic Soil Group: A
Ecological site: F149BY100NY - Urban Site Complex
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Human transported material

Typical profile

R - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Hydric soil rating: No

Minor Components

Quonset

Percent of map unit: 5 percent

Landform: Outwash plains, terraces, outwash terraces, eskers

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent

Landform: Terraces, outwash plains, kames

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

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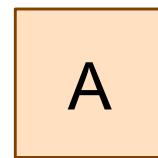
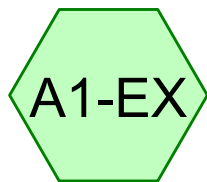
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APPENDIX B

SUPPORTING CALCULATIONS

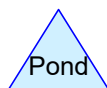
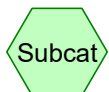
HydroCAD Drainage Analysis
Water Quality Volume Calculations
Groundwater Recharge Calculations

HydroCAD Drainage Analysis



Flow to existing catch
basin

Existing Catch Basin



342-782-Existing Drainage Calcs

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Page 2

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.30	2
2	10-yr	Type III 24-hr		Default	24.00	1	4.90	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.10	2
4	100-yr	Type III 24-hr		Default	24.00	1	8.70	2

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.3	98	Paved parking, HSG D (A1-EX)
1.3	98	TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
1.3	HSG D	A1-EX
0.0	Other	
1.3		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.0	0.0	0.0	1.3	0.0	1.3	Paved parking	A1-EX
0.0	0.0	0.0	1.3	0.0	1.3	TOTAL AREA	

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Storage Five Cranston

Type III 24-hr 2-yr Rainfall=3.30"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-EX: Flow to existing

Runoff Area=56,700 sf 100.00% Impervious Runoff Depth>2.87"

Tc=6.0 min CN=98 Runoff=4.1 cfs 0.311 af

Reach A: Existing Catch Basin

Inflow=4.1 cfs 0.311 af

Outflow=4.1 cfs 0.311 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.311 af Average Runoff Depth = 2.87"

0.00% Pervious = 0.0 ac 100.00% Impervious = 1.3 ac

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Summary for Subcatchment A1-EX: Flow to existing catch basin

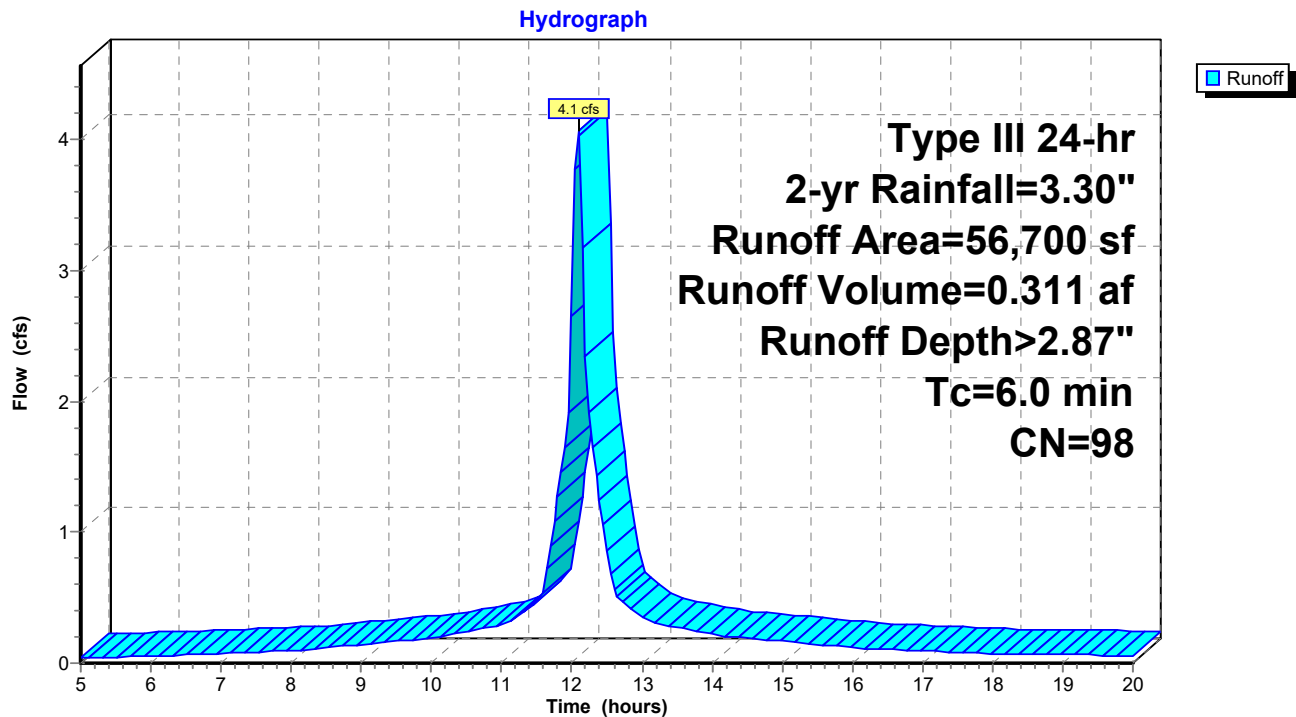
Runoff = 4.1 cfs @ 12.09 hrs, Volume= 0.311 af, Depth> 2.87"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.30"

Area (sf)	CN	Description
56,700	98	Paved parking, HSG D
56,700		100.00% Impervious Area

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

Subcatchment A1-EX: Flow to existing catch basin



342-782-Existing Drainage Calcs

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Storage Five Cranston
Type III 24-hr 2-yr Rainfall=3.30"

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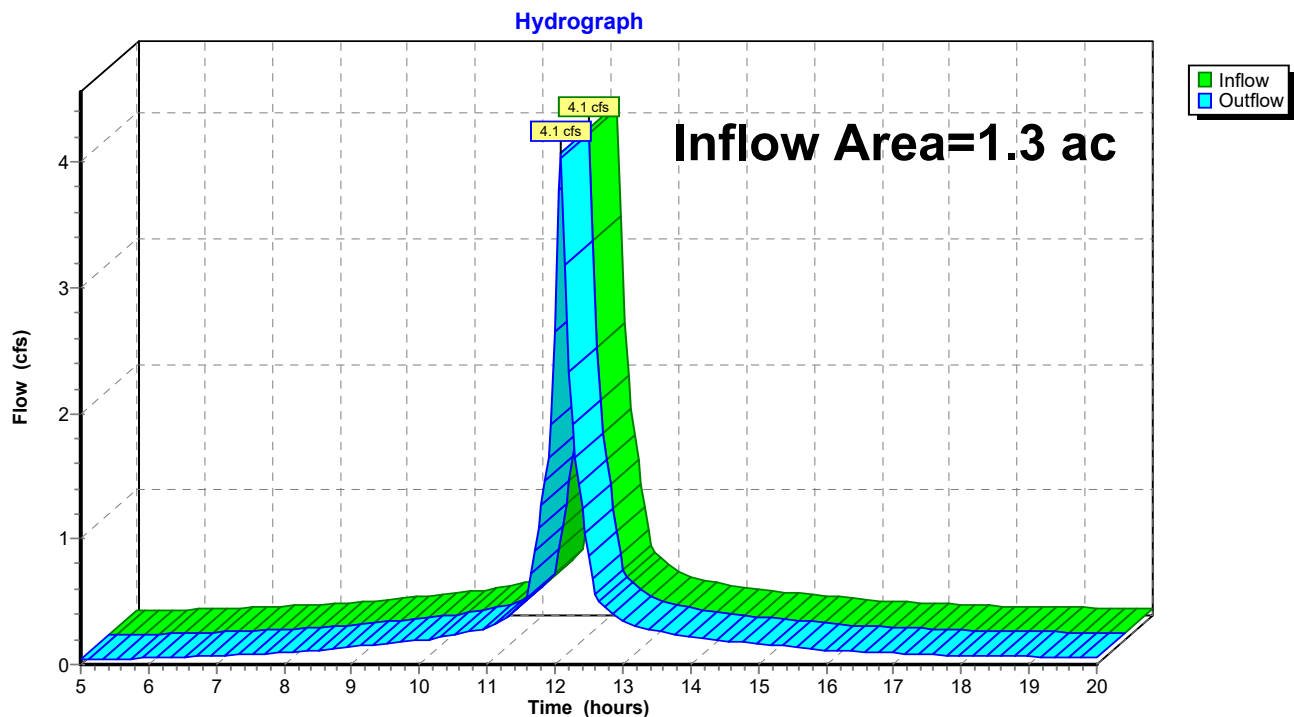
Summary for Reach A: Existing Catch Basin

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

Inflow Area = 1.3 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-yr event
Inflow = 4.1 cfs @ 12.09 hrs, Volume= 0.311 af
Outflow = 4.1 cfs @ 12.09 hrs, Volume= 0.311 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin



342-782-Existing Drainage Calcs

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Storage Five Cranston

Type III 24-hr 10-yr Rainfall=4.90"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-EX: Flow to existing

Runoff Area=56,700 sf 100.00% Impervious Runoff Depth>4.33"

Tc=6.0 min CN=98 Runoff=6.1 cfs 0.469 af

Reach A: Existing Catch Basin

Inflow=6.1 cfs 0.469 af

Outflow=6.1 cfs 0.469 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.469 af Average Runoff Depth = 4.33"

0.00% Pervious = 0.0 ac 100.00% Impervious = 1.3 ac

342-782-Existing Drainage Calcs

Prepared by CEC Inc

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Storage Five Cranston

Type III 24-hr 10-yr Rainfall=4.90"

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Page 10

Summary for Subcatchment A1-EX: Flow to existing catch basin

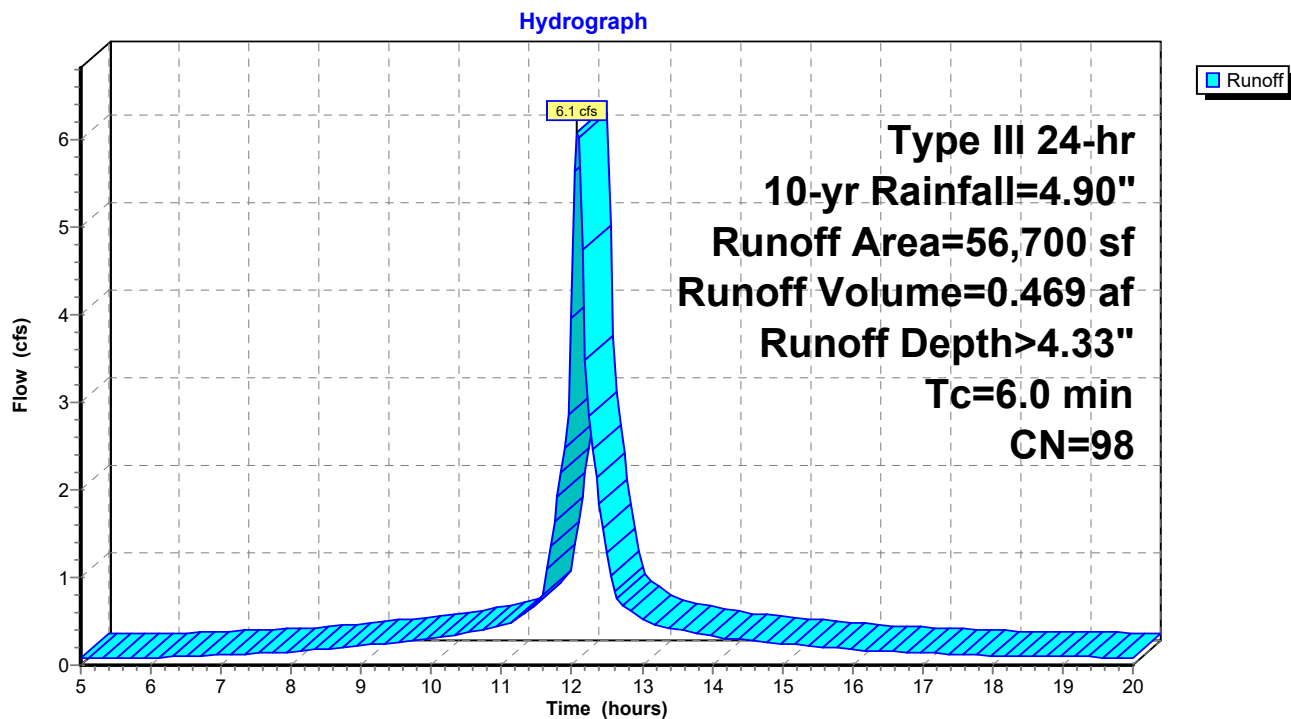
Runoff = 6.1 cfs @ 12.09 hrs, Volume= 0.469 af, Depth> 4.33"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.90"

Area (sf)	CN	Description
56,700	98	Paved parking, HSG D
56,700		100.00% Impervious Area

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

Subcatchment A1-EX: Flow to existing catch basin



342-782-Existing Drainage Calcs

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Storage Five Cranston

Type III 24-hr 10-yr Rainfall=4.90"

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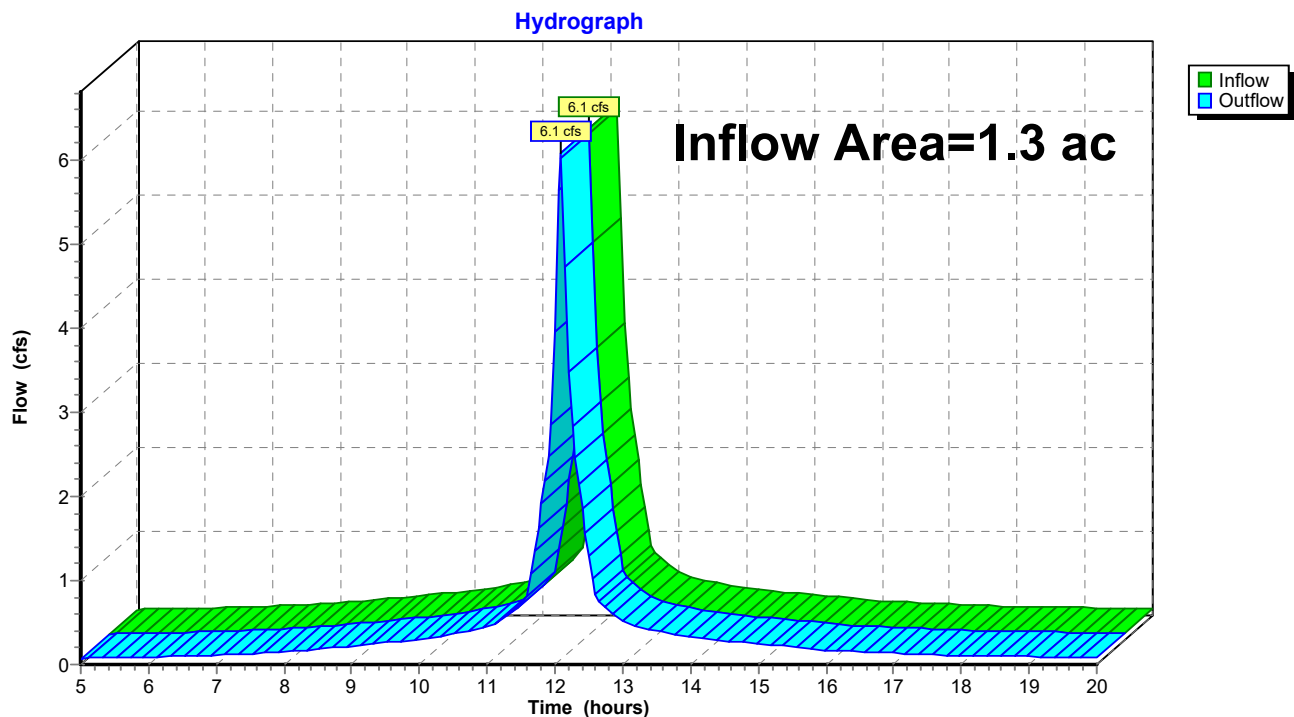
Summary for Reach A: Existing Catch Basin

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

Inflow Area = 1.3 ac, 100.00% Impervious, Inflow Depth > 4.33" for 10-yr event
Inflow = 6.1 cfs @ 12.09 hrs, Volume= 0.469 af
Outflow = 6.1 cfs @ 12.09 hrs, Volume= 0.469 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin



342-782-Existing Drainage Calcs

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Storage Five Cranston
Type III 24-hr 25-yr Rainfall=6.10"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-EX: Flow to existing Runoff Area=56,700 sf 100.00% Impervious Runoff Depth>5.42"
Tc=6.0 min CN=98 Runoff=7.6 cfs 0.588 af

Reach A: Existing Catch Basin

Inflow=7.6 cfs 0.588 af
Outflow=7.6 cfs 0.588 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.588 af Average Runoff Depth = 5.42"
0.00% Pervious = 0.0 ac 100.00% Impervious = 1.3 ac

342-782-Existing Drainage Calcs

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Storage Five Cranston

Type III 24-hr 25-yr Rainfall=6.10"

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Summary for Subcatchment A1-EX: Flow to existing catch basin

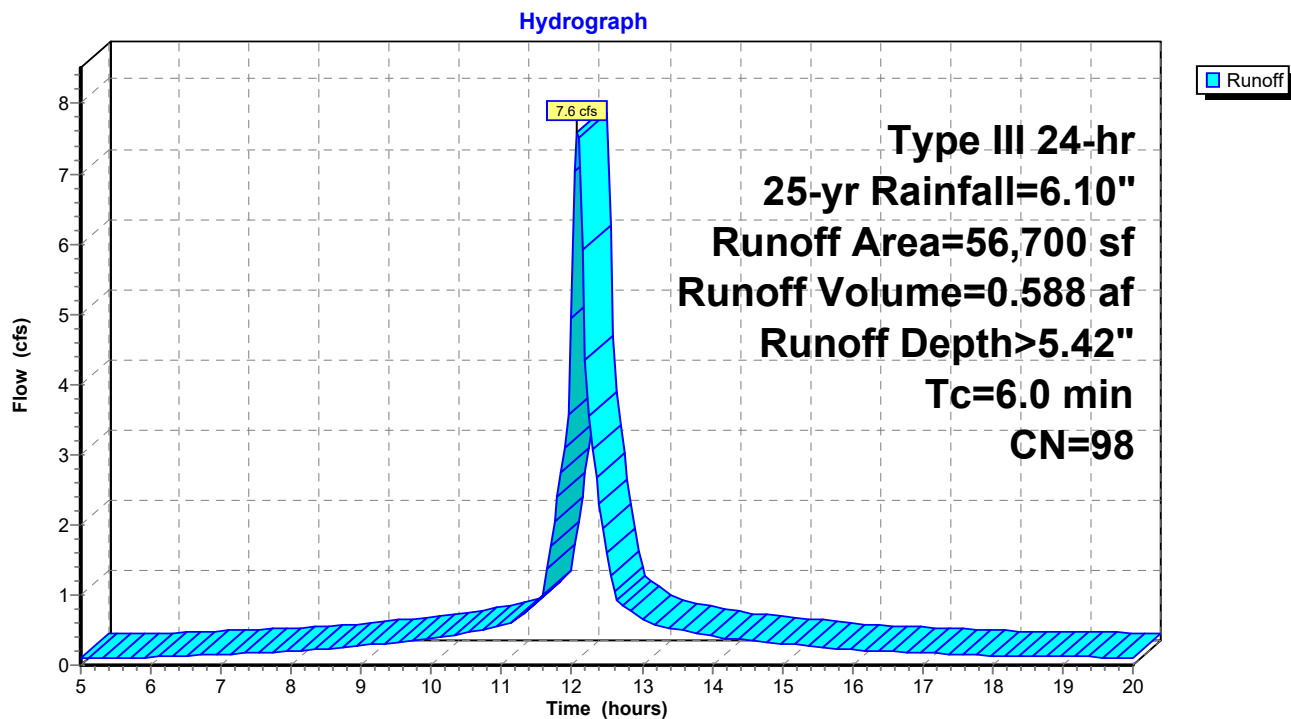
Runoff = 7.6 cfs @ 12.09 hrs, Volume= 0.588 af, Depth> 5.42"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
56,700	98	Paved parking, HSG D
56,700		100.00% Impervious Area

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

Subcatchment A1-EX: Flow to existing catch basin



342-782-Existing Drainage Calcs

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Storage Five Cranston

Type III 24-hr 25-yr Rainfall=6.10"

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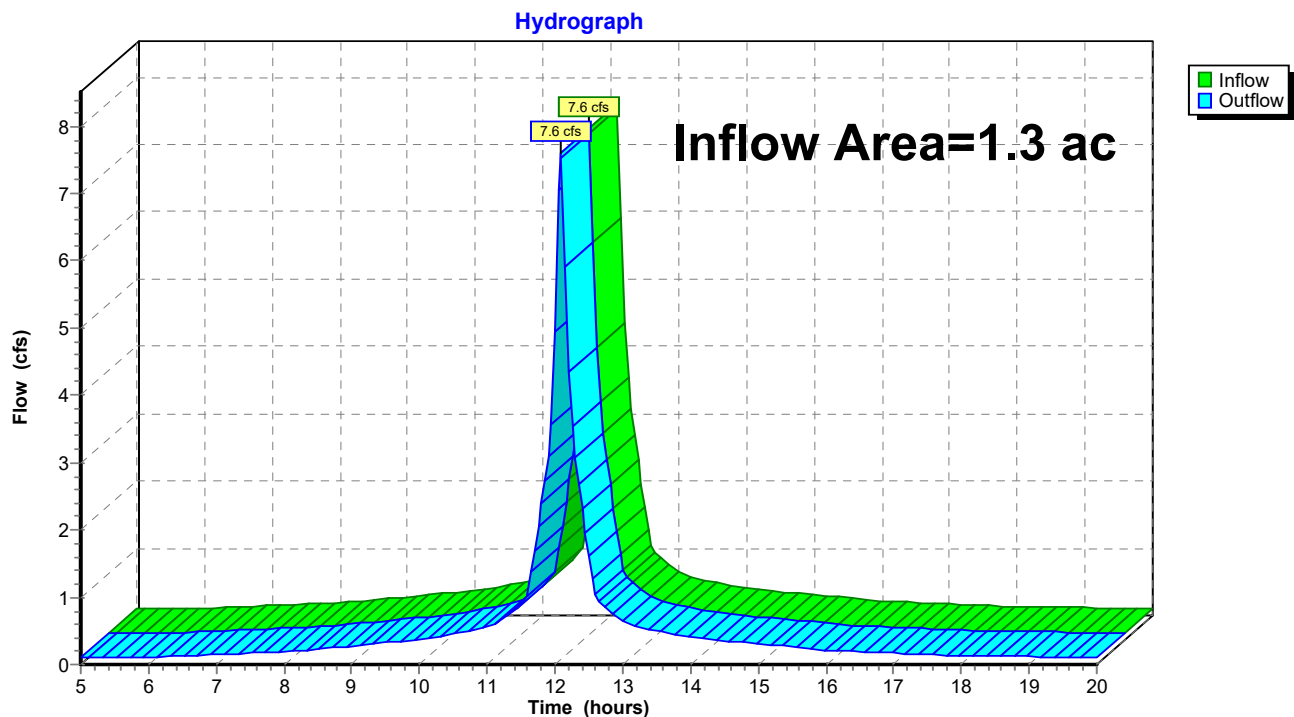
Summary for Reach A: Existing Catch Basin

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

Inflow Area = 1.3 ac, 100.00% Impervious, Inflow Depth > 5.42" for 25-yr event
Inflow = 7.6 cfs @ 12.09 hrs, Volume= 0.588 af
Outflow = 7.6 cfs @ 12.09 hrs, Volume= 0.588 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin



342-782-Existing Drainage Calcs

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Storage Five Cranston

Type III 24-hr 100-yr Rainfall=8.70"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-EX: Flow to existing

Runoff Area=56,700 sf 100.00% Impervious Runoff Depth>7.78"

Tc=6.0 min CN=98 Runoff=10.9 cfs 0.844 af

Reach A: Existing Catch Basin

Inflow=10.9 cfs 0.844 af

Outflow=10.9 cfs 0.844 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.844 af Average Runoff Depth = 7.78"

0.00% Pervious = 0.0 ac 100.00% Impervious = 1.3 ac

342-782-Existing Drainage Calcs

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Type III 24-hr 100-yr Rainfall=8.70"

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Summary for Subcatchment A1-EX: Flow to existing catch basin

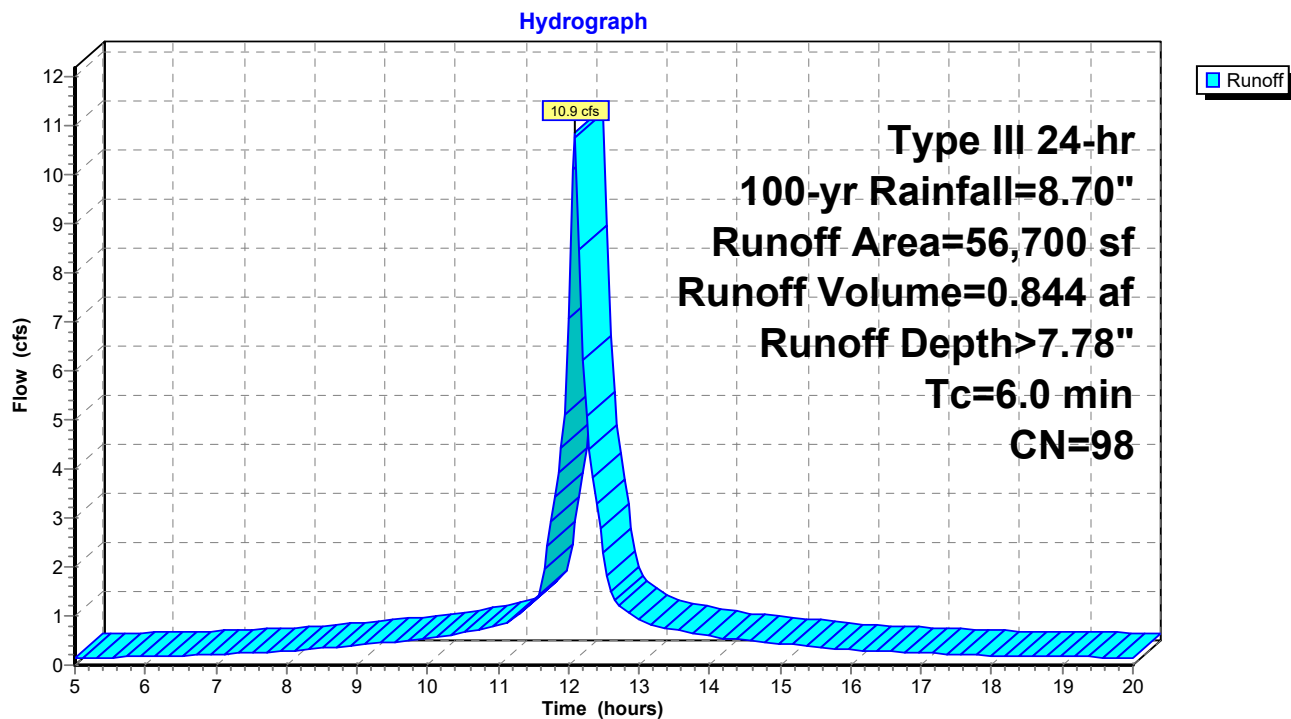
Runoff = 10.9 cfs @ 12.09 hrs, Volume= 0.844 af, Depth> 7.78"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.70"

Area (sf)	CN	Description
56,700	98	Paved parking, HSG D
56,700		100.00% Impervious Area

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

Subcatchment A1-EX: Flow to existing catch basin



342-782-Existing Drainage Calcs

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Storage Five Cranston

Type III 24-hr 100-yr Rainfall=8.70"

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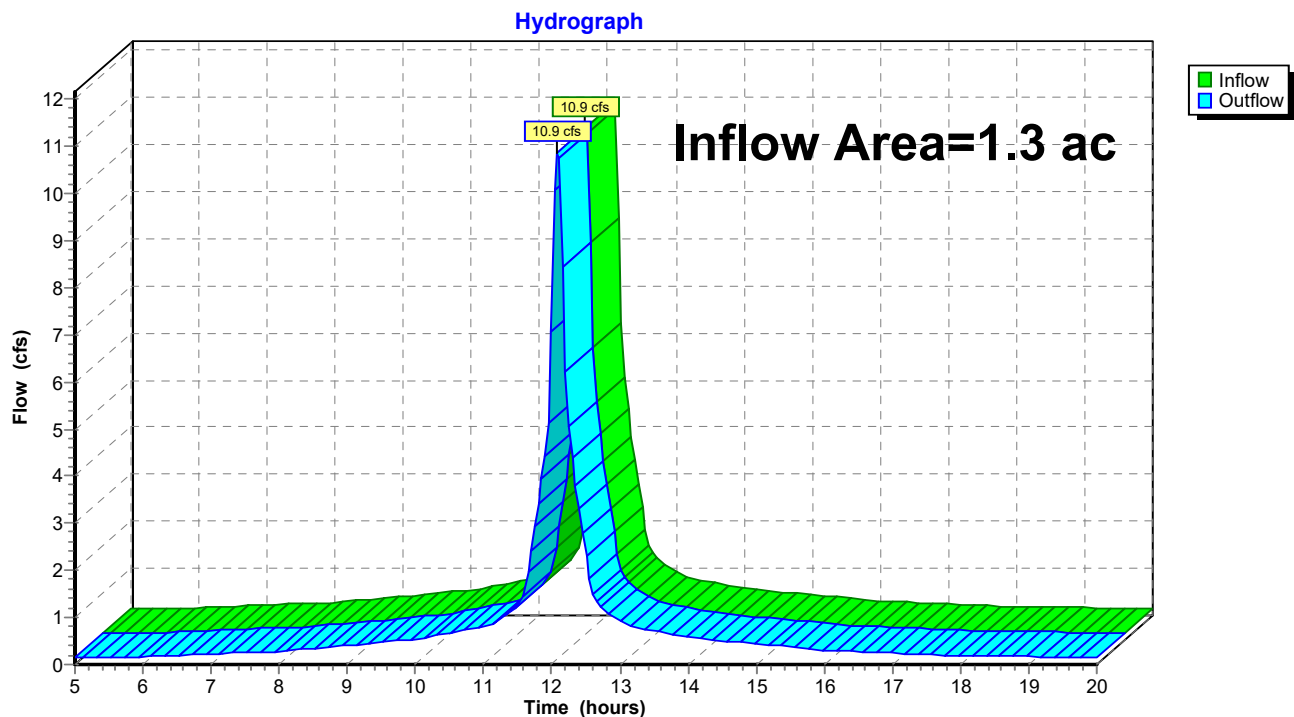
Summary for Reach A: Existing Catch Basin

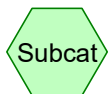
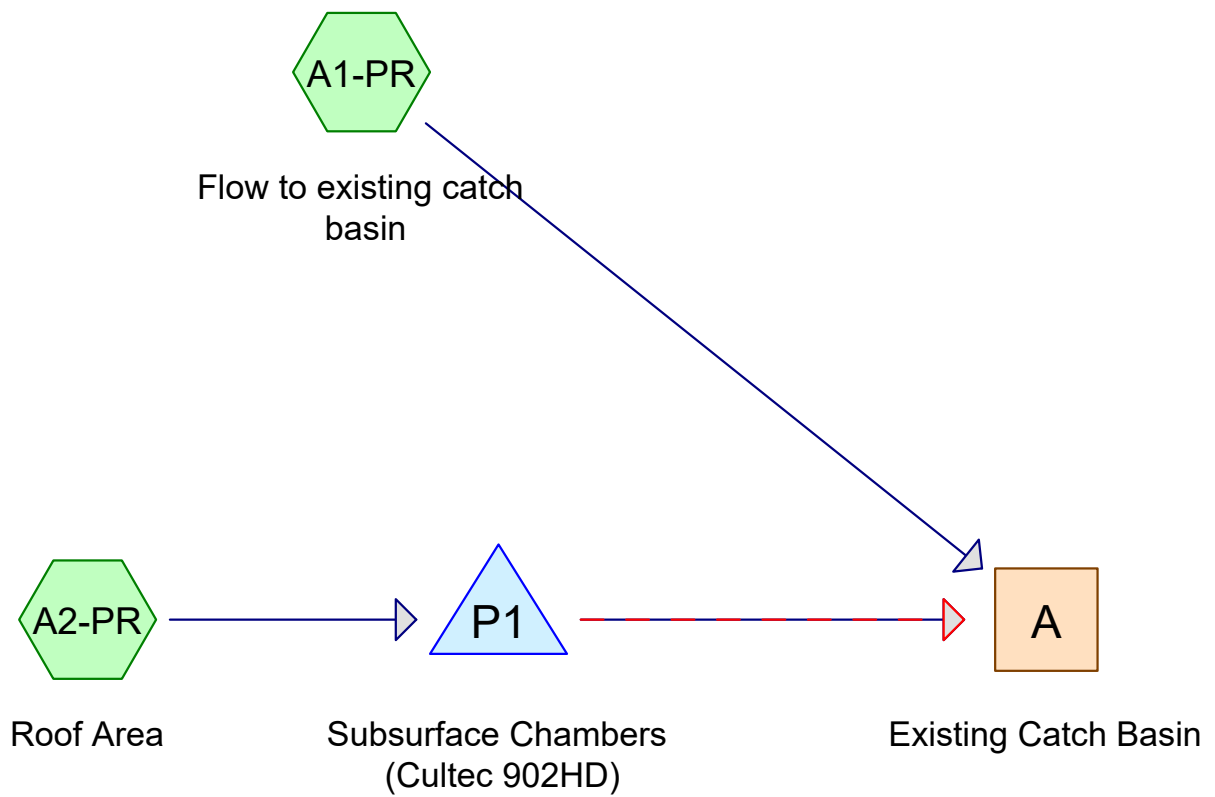
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.3 ac, 100.00% Impervious, Inflow Depth > 7.78" for 100-yr event
Inflow = 10.9 cfs @ 12.09 hrs, Volume= 0.844 af
Outflow = 10.9 cfs @ 12.09 hrs, Volume= 0.844 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin

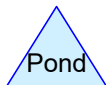




Subcat



Reach



Pond



Link

Routing Diagram for 342-782-Post Drainage Calcs
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342-782-Post Drainage Calcs

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Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-yr	Type III 24-hr		Default	24.00	1	3.30	2
2	10-yr	Type III 24-hr		Default	24.00	1	4.90	2
3	25-yr	Type III 24-hr		Default	24.00	1	6.10	2
4	100-yr	Type III 24-hr		Default	24.00	1	8.70	2

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.0	80	>75% Grass cover, Good, HSG D (A1-PR)
1.0	98	Paved parking, HSG D (A1-PR)
0.3	98	Roofs, HSG D (A2-PR)
1.3	98	TOTAL AREA

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Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.0	HSG A	
0.0	HSG B	
0.0	HSG C	
1.3	HSG D	A1-PR, A2-PR
0.0	Other	
1.3		TOTAL AREA

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Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.0	0.0	0.0	0.0	0.0	0.0	>75% Grass cover, Good	A1-PR
0.0	0.0	0.0	1.0	0.0	1.0	Paved parking	A1-PR
0.0	0.0	0.0	0.3	0.0	0.3	Roofs	A2-PR
0.0	0.0	0.0	1.3	0.0	1.3	TOTAL AREA	

342-782-Post Drainage Calcs

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Storage Five Cranston

Type III 24-hr 2-yr Rainfall=3.30"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-PR: Flow to existing

Runoff Area=43,075 sf 97.68% Impervious Runoff Depth>2.87"

Tc=6.0 min CN=98 Runoff=3.1 cfs 0.236 af

SubcatchmentA2-PR: Roof Area

Runoff Area=13,625 sf 100.00% Impervious Runoff Depth>2.87"

Tc=6.0 min CN=98 Runoff=1.0 cfs 0.075 af

Reach A: Existing Catch Basin

Inflow=4.0 cfs 0.282 af

Outflow=4.0 cfs 0.282 af

Pond P1: Subsurface Chambers (Cultec

Peak Elev=68.29' Storage=1,323 cf Inflow=1.0 cfs 0.075 af

Outflow=1.1 cfs 0.045 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.311 af Average Runoff Depth = 2.87"

1.76% Pervious = 0.0 ac 98.24% Impervious = 1.3 ac

342-782-Post Drainage Calcs

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Storage Five Cranston

Type III 24-hr 2-yr Rainfall=3.30"

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Summary for Subcatchment A1-PR: Flow to existing catch basin

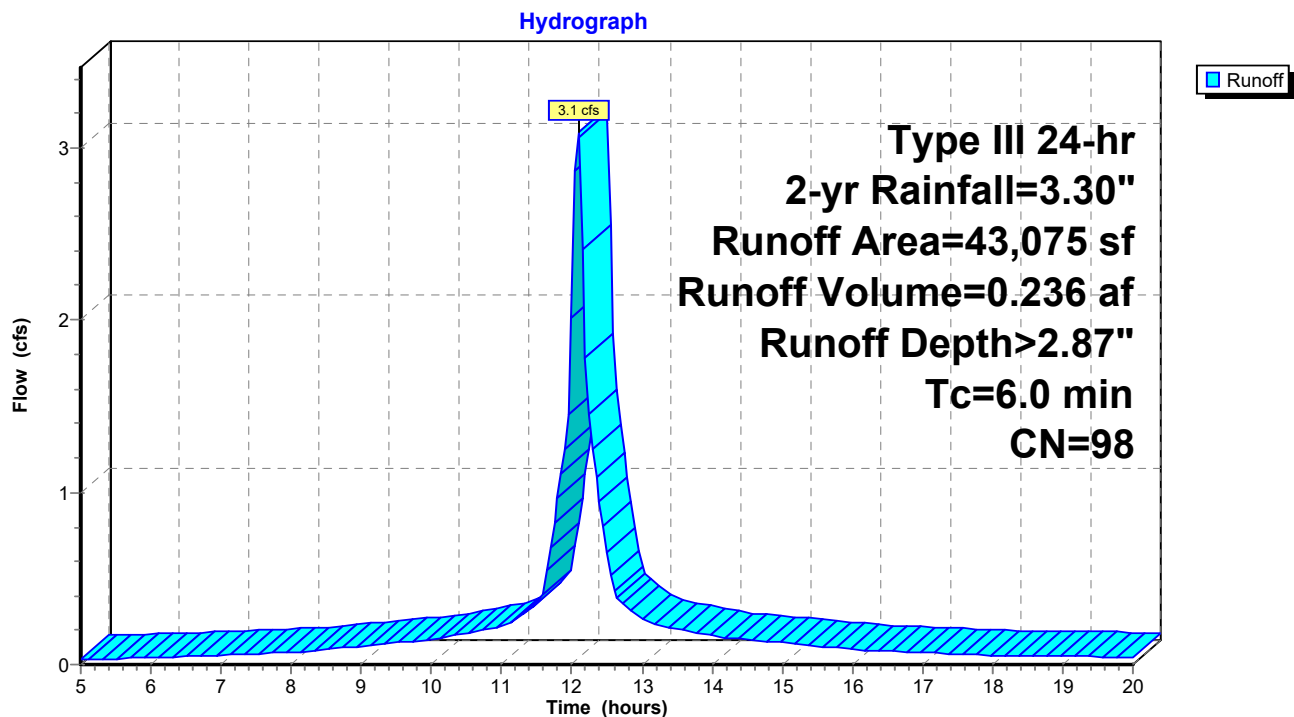
Runoff = 3.1 cfs @ 12.09 hrs, Volume= 0.236 af, Depth> 2.87"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.30"

Area (sf)	CN	Description
42,075	98	Paved parking, HSG D
1,000	80	>75% Grass cover, Good, HSG D
43,075	98	Weighted Average
1,000		2.32% Pervious Area
42,075		97.68% Impervious Area

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

Subcatchment A1-PR: Flow to existing catch basin



342-782-Post Drainage Calcs

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Type III 24-hr 2-yr Rainfall=3.30"

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Summary for Subcatchment A2-PR: Roof Area

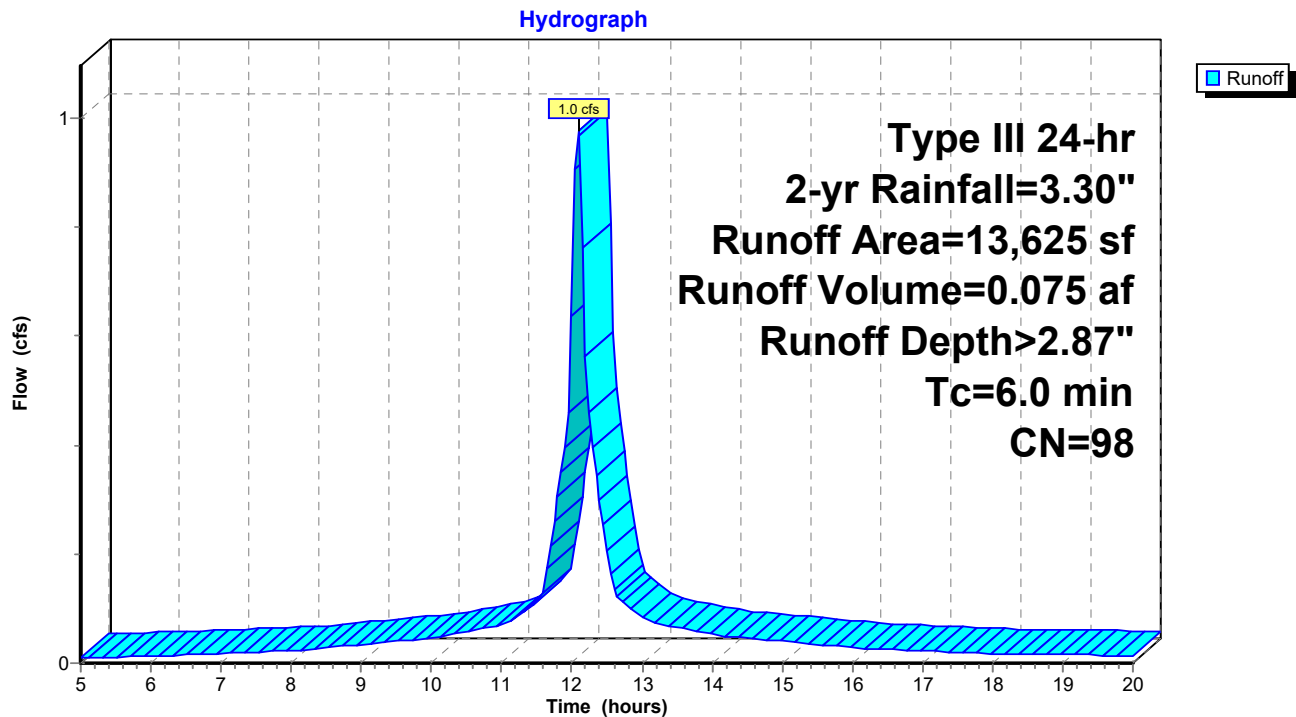
Runoff = 1.0 cfs @ 12.09 hrs, Volume= 0.075 af, Depth> 2.87"
Routed to Pond P1 : Subsurface Chambers (Cultec 902HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.30"

Area (sf)	CN	Description
13,625	98	Roofs, HSG D
13,625		100.00% Impervious Area

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

Subcatchment A2-PR: Roof Area



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Storage Five Cranston

Type III 24-hr 2-yr Rainfall=3.30"

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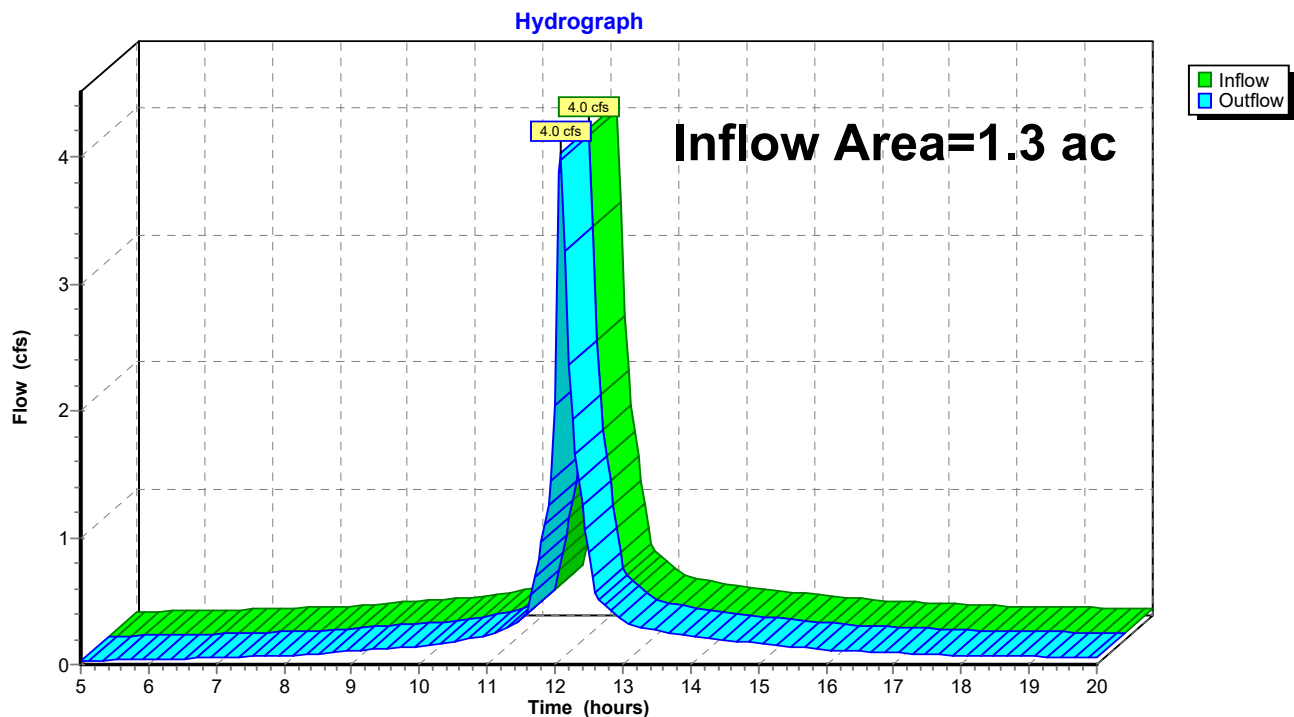
Summary for Reach A: Existing Catch Basin

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

Inflow Area = 1.3 ac, 98.24% Impervious, Inflow Depth > 2.60" for 2-yr event
Inflow = 4.0 cfs @ 12.08 hrs, Volume= 0.282 af
Outflow = 4.0 cfs @ 12.08 hrs, Volume= 0.282 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin



342-782-Post Drainage Calcs

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Storage Five Cranston

Type III 24-hr 2-yr Rainfall=3.30"

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Summary for Pond P1: Subsurface Chambers (Cultec 902HD)

[82] Warning: Early inflow requires earlier time span

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 0.3 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-yr event
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 0.075 af
Outflow = 1.1 cfs @ 12.07 hrs, Volume= 0.045 af, Atten= 0%, Lag= 0.0 min
Primary = 1.1 cfs @ 12.07 hrs, Volume= 0.045 af
Routed to Reach A : Existing Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 68.29' @ 12.05 hrs Surf.Area= 421 sf Storage= 1,323 cf

Plug-Flow detention time= 154.1 min calculated for 0.045 af (61% of inflow)
Center-of-Mass det. time= 76.0 min (814.3 - 738.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.00'	682 cf	9.50'W x 44.37'L x 5.75'H Field A 2,424 cf Overall - 718 cf Embedded = 1,706 cf x 40.0% Voids
#2A	63.75'	718 cf	Cultec R-902HD x 11 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf
		1,400 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	12.0" Round Culvert L= 58.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 67.00' / 66.40' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	68.00'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s) 4.0' Crest Height
#3	Device 1	68.50'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.0 cfs @ 12.07 hrs HW=68.28' (Free Discharge)

1=Culvert (Passes 1.0 cfs of 2.6 cfs potential flow)

2=Sharp-Crested Rectangular Weir (Weir Controls 1.0 cfs @ 1.75 fps)

3=Broad-Crested Rectangular Weir (Controls 0.0 cfs)

342-782-Post Drainage Calcs

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Storage Five Cranston
Type III 24-hr 2-yr Rainfall=3.30"

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Pond P1: Subsurface Chambers (Cultec 902HD) - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger®902HD)

Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf

Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap

Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf

11 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 41.37' Row Length +18.0" End Stone x 2 = 44.37' Base Length

1 Rows x 78.0" Wide + 18.0" Side Stone x 2 = 9.50' Base Width

9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

11 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 1 Rows = 717.6 cf Chamber Storage

2,423.5 cf Field - 717.6 cf Chambers = 1,705.9 cf Stone x 40.0% Voids = 682.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,400.0 cf = 0.032 af

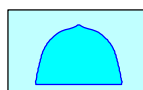
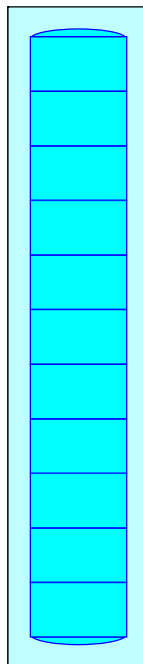
Overall Storage Efficiency = 57.8%

Overall System Size = 44.37' x 9.50' x 5.75'

11 Chambers

89.8 cy Field

63.2 cy Stone



342-782-Post Drainage Calcs

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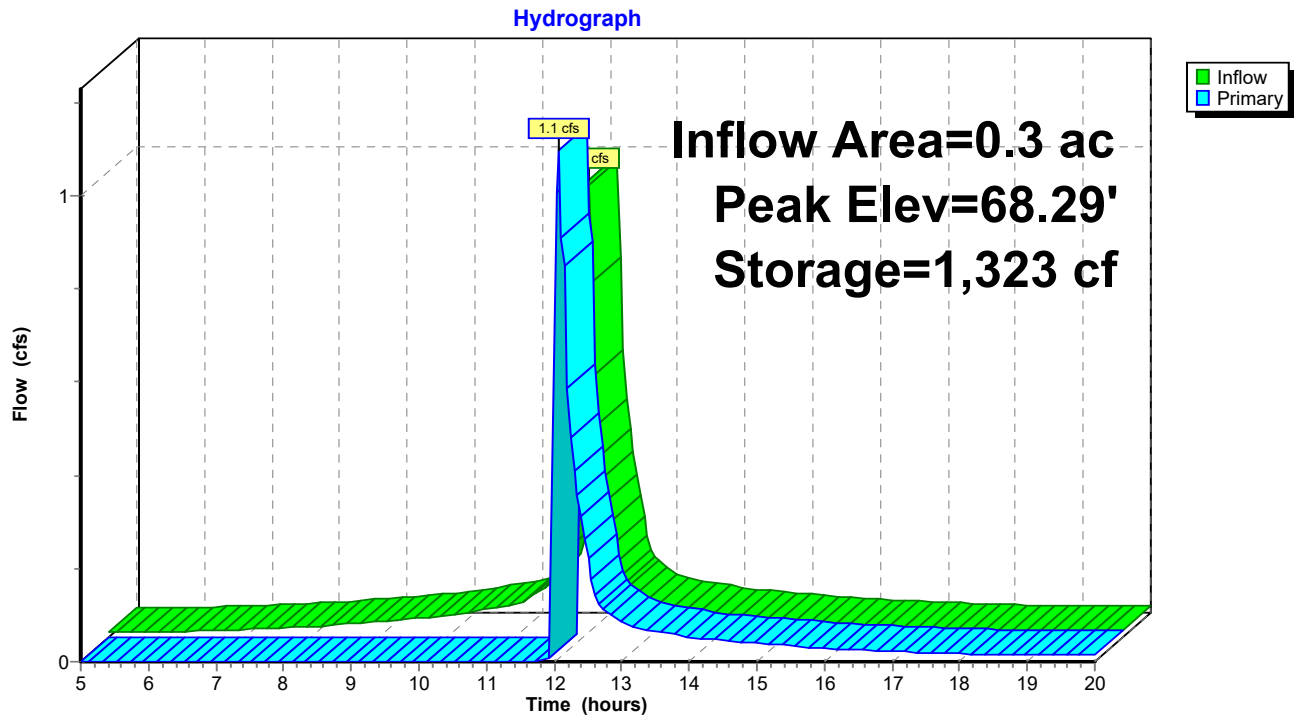
Storage Five Cranston

Type III 24-hr 2-yr Rainfall=3.30"

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Pond P1: Subsurface Chambers (Cultec 902HD)



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Type III 24-hr 2-yr Rainfall=3.30"

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Stage-Area-Storage for Pond P1: Subsurface Chambers (Cultec 902HD)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
63.00	0	65.55	671	68.10	1,290
63.05	8	65.60	685	68.15	1,299
63.10	17	65.65	700	68.20	1,307
63.15	25	65.70	714	68.25	1,316
63.20	34	65.75	729	68.30	1,324
63.25	42	65.80	743	68.35	1,333
63.30	51	65.85	758	68.40	1,341
63.35	59	65.90	772	68.45	1,349
63.40	67	65.95	786	68.50	1,358
63.45	76	66.00	801	68.55	1,366
63.50	84	66.05	815	68.60	1,375
63.55	93	66.10	829	68.65	1,383
63.60	101	66.15	843	68.70	1,392
63.65	110	66.20	857	68.75	1,400
63.70	118	66.25	871		
63.75	126	66.30	885		
63.80	142	66.35	899		
63.85	157	66.40	913		
63.90	173	66.45	927		
63.95	188	66.50	940		
64.00	204	66.55	954		
64.05	219	66.60	967		
64.10	235	66.65	981		
64.15	250	66.70	994		
64.20	265	66.75	1,007		
64.25	281	66.80	1,020		
64.30	296	66.85	1,033		
64.35	311	66.90	1,046		
64.40	327	66.95	1,058		
64.45	342	67.00	1,071		
64.50	357	67.05	1,083		
64.55	372	67.10	1,095		
64.60	388	67.15	1,108		
64.65	403	67.20	1,119		
64.70	418	67.25	1,131		
64.75	433	67.30	1,143		
64.80	448	67.35	1,154		
64.85	463	67.40	1,165		
64.90	478	67.45	1,175		
64.95	493	67.50	1,186		
65.00	508	67.55	1,195		
65.05	523	67.60	1,205		
65.10	538	67.65	1,214		
65.15	553	67.70	1,223		
65.20	568	67.75	1,231		
65.25	582	67.80	1,240		
65.30	597	67.85	1,248		
65.35	612	67.90	1,257		
65.40	627	67.95	1,265		
65.45	641	68.00	1,274		
65.50	656	68.05	1,282		

342-782-Post Drainage Calcs

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Storage Five Cranston

Type III 24-hr 10-yr Rainfall=4.90"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-PR: Flow to existing

Runoff Area=43,075 sf 97.68% Impervious Runoff Depth>4.33"

Tc=6.0 min CN=98 Runoff=4.6 cfs 0.357 af

SubcatchmentA2-PR: Roof Area

Runoff Area=13,625 sf 100.00% Impervious Runoff Depth>4.33"

Tc=6.0 min CN=98 Runoff=1.5 cfs 0.113 af

Reach A: Existing Catch Basin

Inflow=6.1 cfs 0.440 af

Outflow=6.1 cfs 0.440 af

Pond P1: Subsurface Chambers (Cultec

Peak Elev=68.38' Storage=1,337 cf Inflow=1.5 cfs 0.113 af

Outflow=1.5 cfs 0.084 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.469 af Average Runoff Depth = 4.33"

1.76% Pervious = 0.0 ac 98.24% Impervious = 1.3 ac

342-782-Post Drainage Calcs

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Storage Five Cranston

Type III 24-hr 10-yr Rainfall=4.90"

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Summary for Subcatchment A1-PR: Flow to existing catch basin

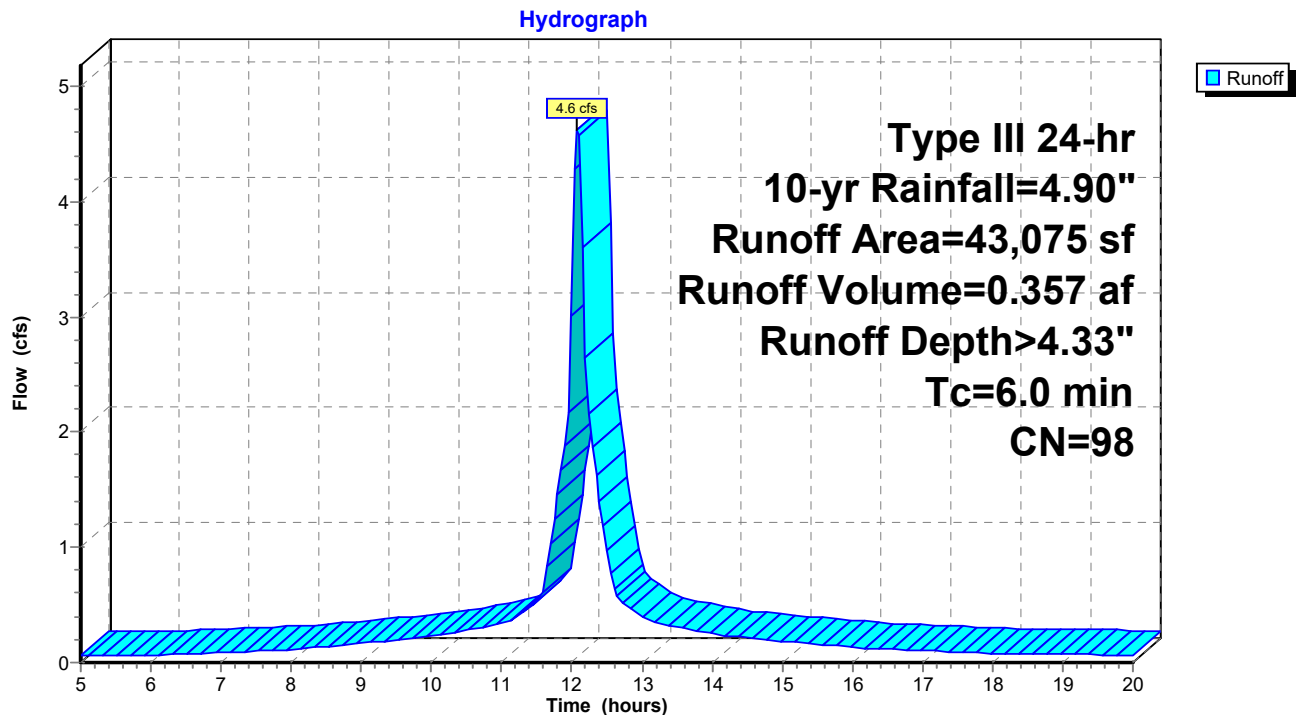
Runoff = 4.6 cfs @ 12.09 hrs, Volume= 0.357 af, Depth> 4.33"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.90"

Area (sf)	CN	Description
42,075	98	Paved parking, HSG D
1,000	80	>75% Grass cover, Good, HSG D
43,075	98	Weighted Average
1,000		2.32% Pervious Area
42,075		97.68% Impervious Area

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

Subcatchment A1-PR: Flow to existing catch basin



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Type III 24-hr 10-yr Rainfall=4.90"

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Summary for Subcatchment A2-PR: Roof Area

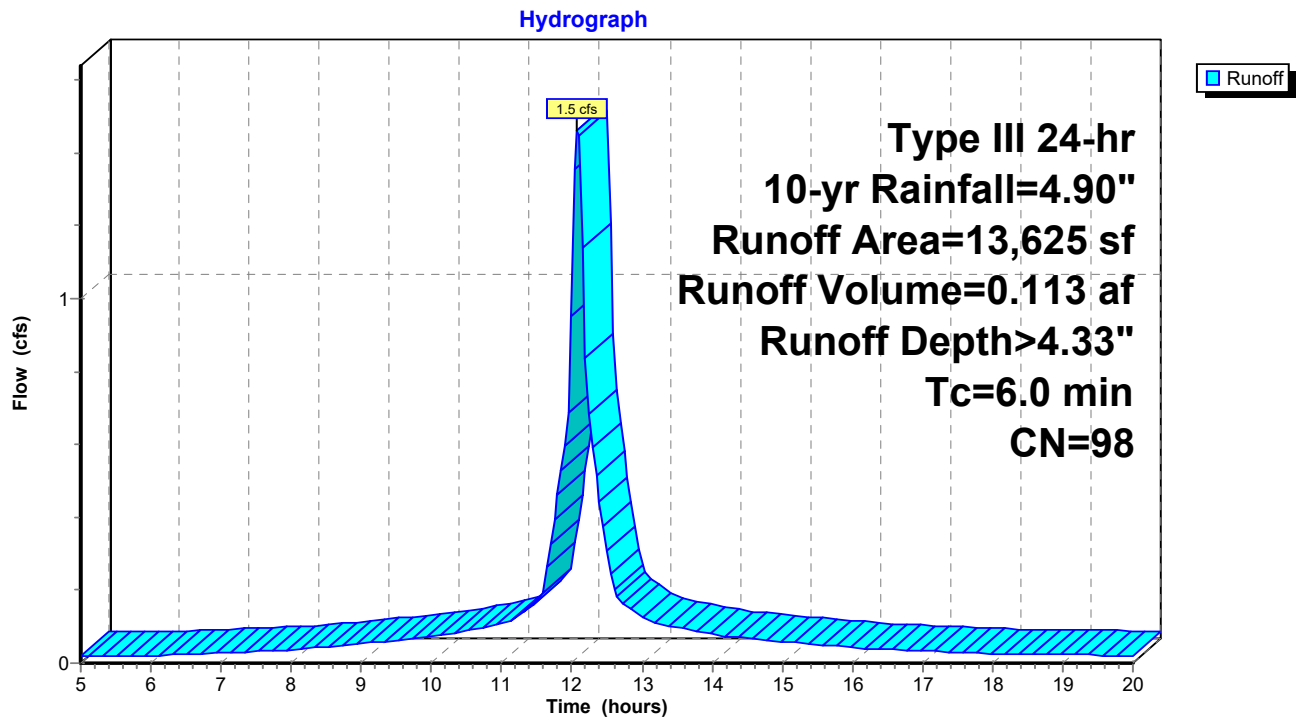
Runoff = 1.5 cfs @ 12.09 hrs, Volume= 0.113 af, Depth> 4.33"
Routed to Pond P1 : Subsurface Chambers (Cultec 902HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.90"

Area (sf)	CN	Description
13,625	98	Roofs, HSG D
13,625		100.00% Impervious Area

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

Subcatchment A2-PR: Roof Area



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Type III 24-hr 10-yr Rainfall=4.90"

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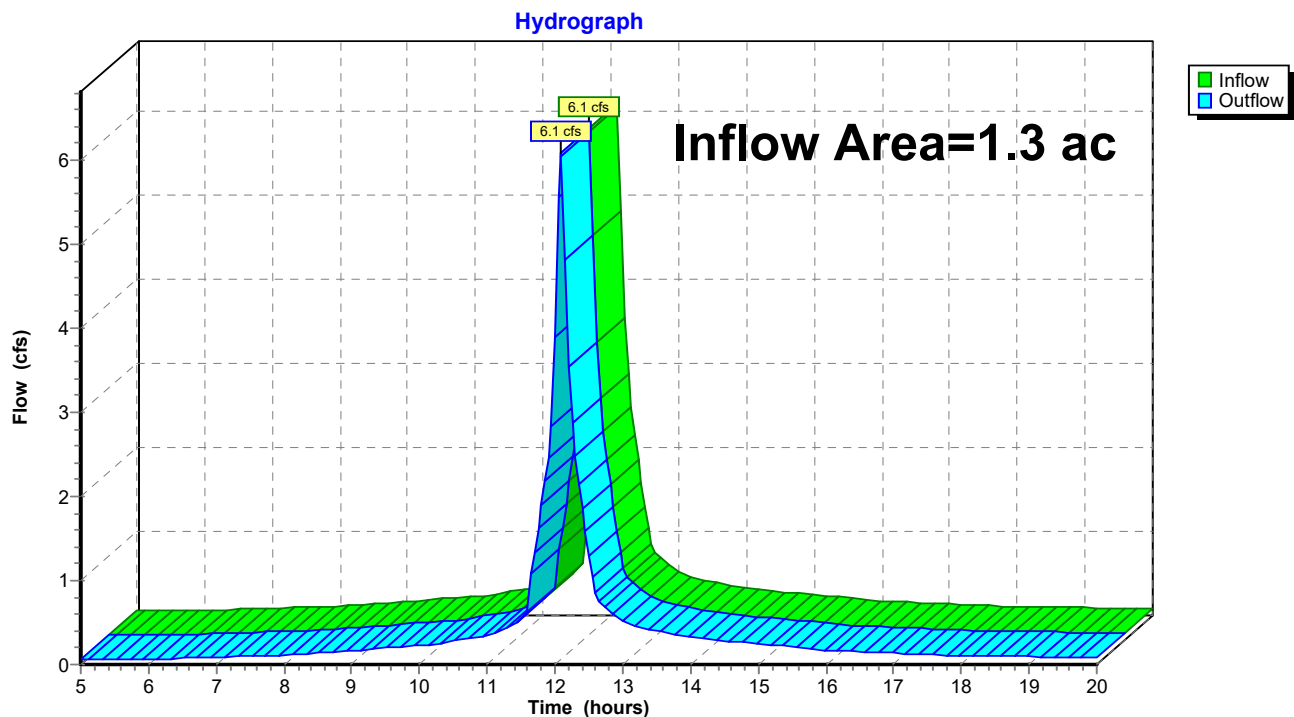
Summary for Reach A: Existing Catch Basin

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

Inflow Area = 1.3 ac, 98.24% Impervious, Inflow Depth > 4.06" for 10-yr event
Inflow = 6.1 cfs @ 12.09 hrs, Volume= 0.440 af
Outflow = 6.1 cfs @ 12.09 hrs, Volume= 0.440 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin



342-782-Post Drainage Calcs

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Type III 24-hr 10-yr Rainfall=4.90"

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Summary for Pond P1: Subsurface Chambers (Cultec 902HD)

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.3 ac, 100.00% Impervious, Inflow Depth > 4.33" for 10-yr event
Inflow = 1.5 cfs @ 12.09 hrs, Volume= 0.113 af
Outflow = 1.5 cfs @ 12.10 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.6 min
Primary = 1.5 cfs @ 12.10 hrs, Volume= 0.084 af
Routed to Reach A : Existing Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 68.38' @ 12.10 hrs Surf.Area= 421 sf Storage= 1,337 cf

Plug-Flow detention time= 121.8 min calculated for 0.083 af (74% of inflow)
Center-of-Mass det. time= 59.4 min (794.6 - 735.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.00'	682 cf	9.50'W x 44.37'L x 5.75'H Field A 2,424 cf Overall - 718 cf Embedded = 1,706 cf x 40.0% Voids
#2A	63.75'	718 cf	Cultec R-902HD x 11 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf
		1,400 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	12.0" Round Culvert L= 58.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 67.00' / 66.40' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	68.00'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s) 4.0' Crest Height
#3	Device 1	68.50'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.4 cfs @ 12.10 hrs HW=68.37' (Free Discharge)

- 1=Culvert (Passes 1.4 cfs of 2.8 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Weir Controls 1.4 cfs @ 2.02 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.0 cfs)

342-782-Post Drainage Calcs

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Type III 24-hr 10-yr Rainfall=4.90"

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Pond P1: Subsurface Chambers (Cultec 902HD) - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger®902HD)

Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf

Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap

Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf

11 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 41.37' Row Length +18.0" End Stone x 2 = 44.37' Base Length

1 Rows x 78.0" Wide + 18.0" Side Stone x 2 = 9.50' Base Width

9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

11 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 1 Rows = 717.6 cf Chamber Storage

2,423.5 cf Field - 717.6 cf Chambers = 1,705.9 cf Stone x 40.0% Voids = 682.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,400.0 cf = 0.032 af

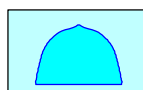
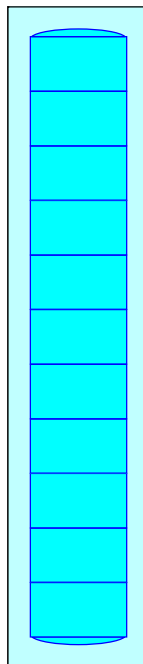
Overall Storage Efficiency = 57.8%

Overall System Size = 44.37' x 9.50' x 5.75'

11 Chambers

89.8 cy Field

63.2 cy Stone



342-782-Post Drainage Calcs

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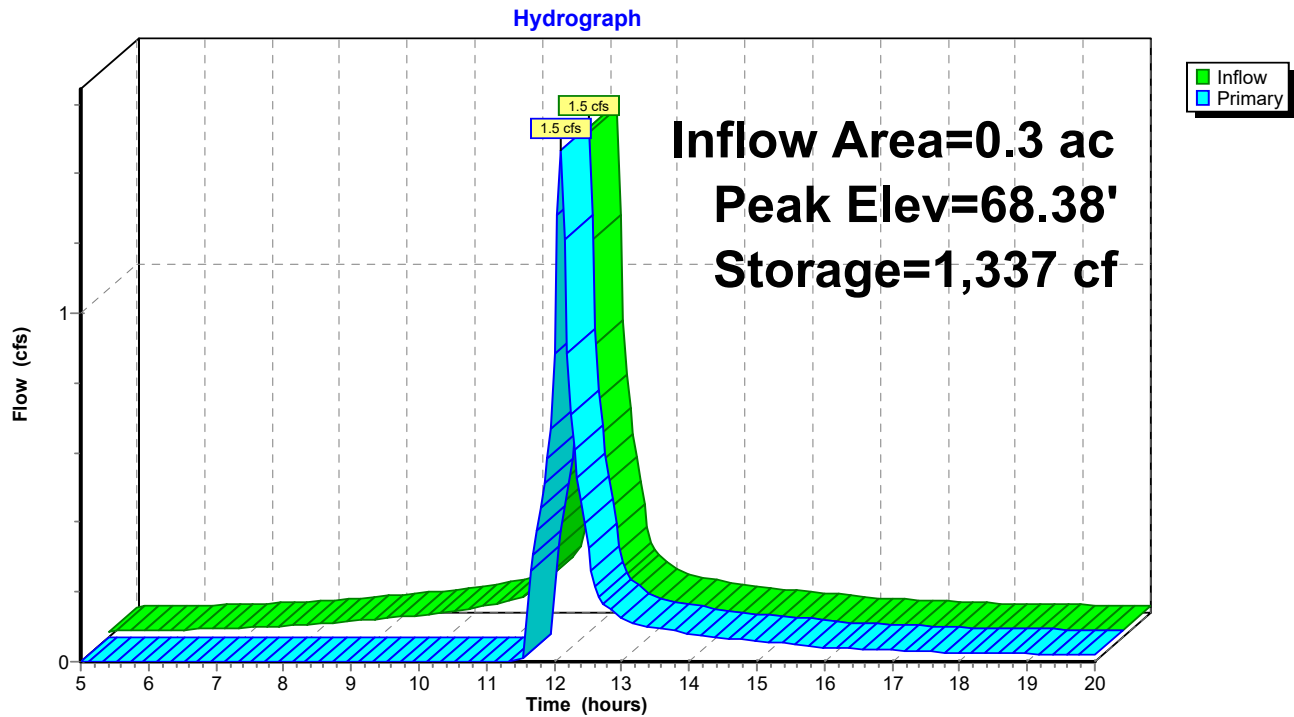
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Type III 24-hr 10-yr Rainfall=4.90"

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Pond P1: Subsurface Chambers (Cultec 902HD)



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Type III 24-hr 10-yr Rainfall=4.90"

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Stage-Area-Storage for Pond P1: Subsurface Chambers (Cultec 902HD)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
63.00	0	65.55	671	68.10	1,290
63.05	8	65.60	685	68.15	1,299
63.10	17	65.65	700	68.20	1,307
63.15	25	65.70	714	68.25	1,316
63.20	34	65.75	729	68.30	1,324
63.25	42	65.80	743	68.35	1,333
63.30	51	65.85	758	68.40	1,341
63.35	59	65.90	772	68.45	1,349
63.40	67	65.95	786	68.50	1,358
63.45	76	66.00	801	68.55	1,366
63.50	84	66.05	815	68.60	1,375
63.55	93	66.10	829	68.65	1,383
63.60	101	66.15	843	68.70	1,392
63.65	110	66.20	857	68.75	1,400
63.70	118	66.25	871		
63.75	126	66.30	885		
63.80	142	66.35	899		
63.85	157	66.40	913		
63.90	173	66.45	927		
63.95	188	66.50	940		
64.00	204	66.55	954		
64.05	219	66.60	967		
64.10	235	66.65	981		
64.15	250	66.70	994		
64.20	265	66.75	1,007		
64.25	281	66.80	1,020		
64.30	296	66.85	1,033		
64.35	311	66.90	1,046		
64.40	327	66.95	1,058		
64.45	342	67.00	1,071		
64.50	357	67.05	1,083		
64.55	372	67.10	1,095		
64.60	388	67.15	1,108		
64.65	403	67.20	1,119		
64.70	418	67.25	1,131		
64.75	433	67.30	1,143		
64.80	448	67.35	1,154		
64.85	463	67.40	1,165		
64.90	478	67.45	1,175		
64.95	493	67.50	1,186		
65.00	508	67.55	1,195		
65.05	523	67.60	1,205		
65.10	538	67.65	1,214		
65.15	553	67.70	1,223		
65.20	568	67.75	1,231		
65.25	582	67.80	1,240		
65.30	597	67.85	1,248		
65.35	612	67.90	1,257		
65.40	627	67.95	1,265		
65.45	641	68.00	1,274		
65.50	656	68.05	1,282		

342-782-Post Drainage Calcs

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Type III 24-hr 25-yr Rainfall=6.10"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-PR: Flow to existing

Runoff Area=43,075 sf 97.68% Impervious Runoff Depth>5.42"

Tc=6.0 min CN=98 Runoff=5.8 cfs 0.447 af

SubcatchmentA2-PR: Roof Area

Runoff Area=13,625 sf 100.00% Impervious Runoff Depth>5.42"

Tc=6.0 min CN=98 Runoff=1.8 cfs 0.141 af

Reach A: Existing Catch Basin

Inflow=7.6 cfs 0.559 af

Outflow=7.6 cfs 0.559 af

Pond P1: Subsurface Chambers (Cultec

Peak Elev=68.44' Storage=1,347 cf Inflow=1.8 cfs 0.141 af

Outflow=1.8 cfs 0.112 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.588 af Average Runoff Depth = 5.42"

1.76% Pervious = 0.0 ac 98.24% Impervious = 1.3 ac

342-782-Post Drainage Calcs

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Type III 24-hr 25-yr Rainfall=6.10"

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Summary for Subcatchment A1-PR: Flow to existing catch basin

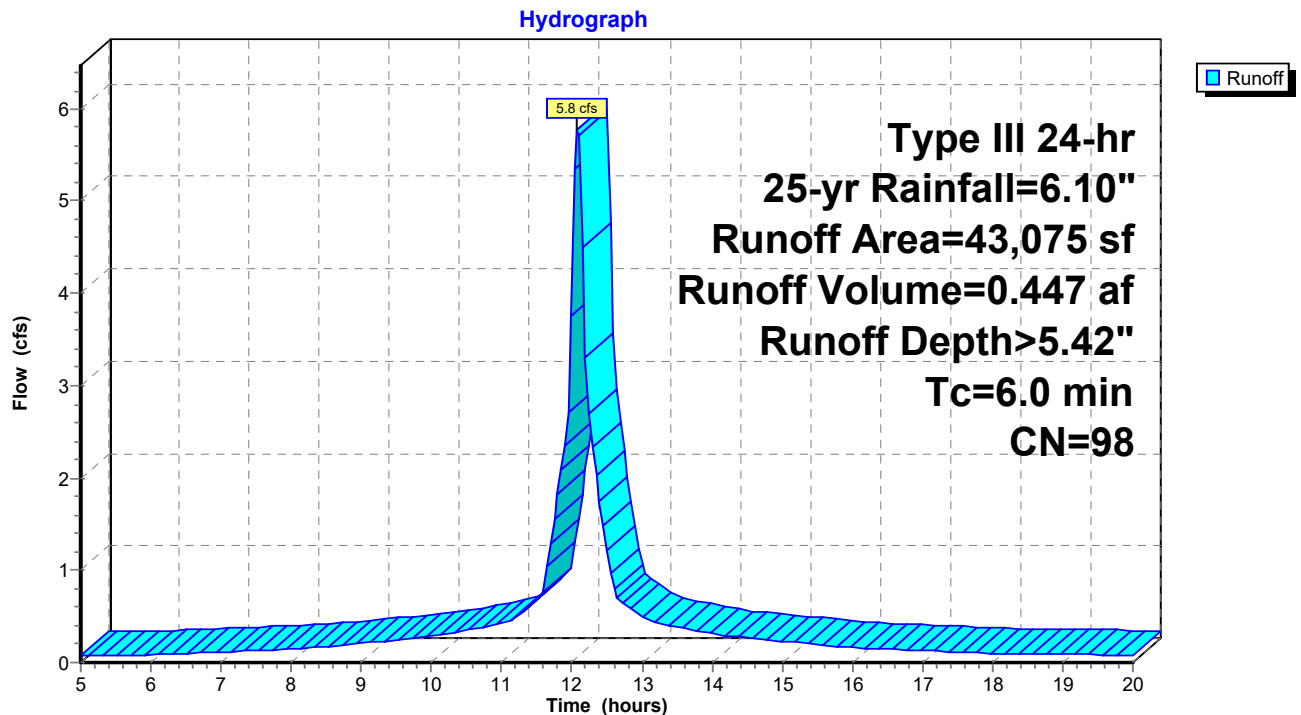
Runoff = 5.8 cfs @ 12.09 hrs, Volume= 0.447 af, Depth> 5.42"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
42,075	98	Paved parking, HSG D
1,000	80	>75% Grass cover, Good, HSG D
43,075	98	Weighted Average
1,000		2.32% Pervious Area
42,075		97.68% Impervious Area

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

Subcatchment A1-PR: Flow to existing catch basin



342-782-Post Drainage Calcs

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Type III 24-hr 25-yr Rainfall=6.10"

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Summary for Subcatchment A2-PR: Roof Area

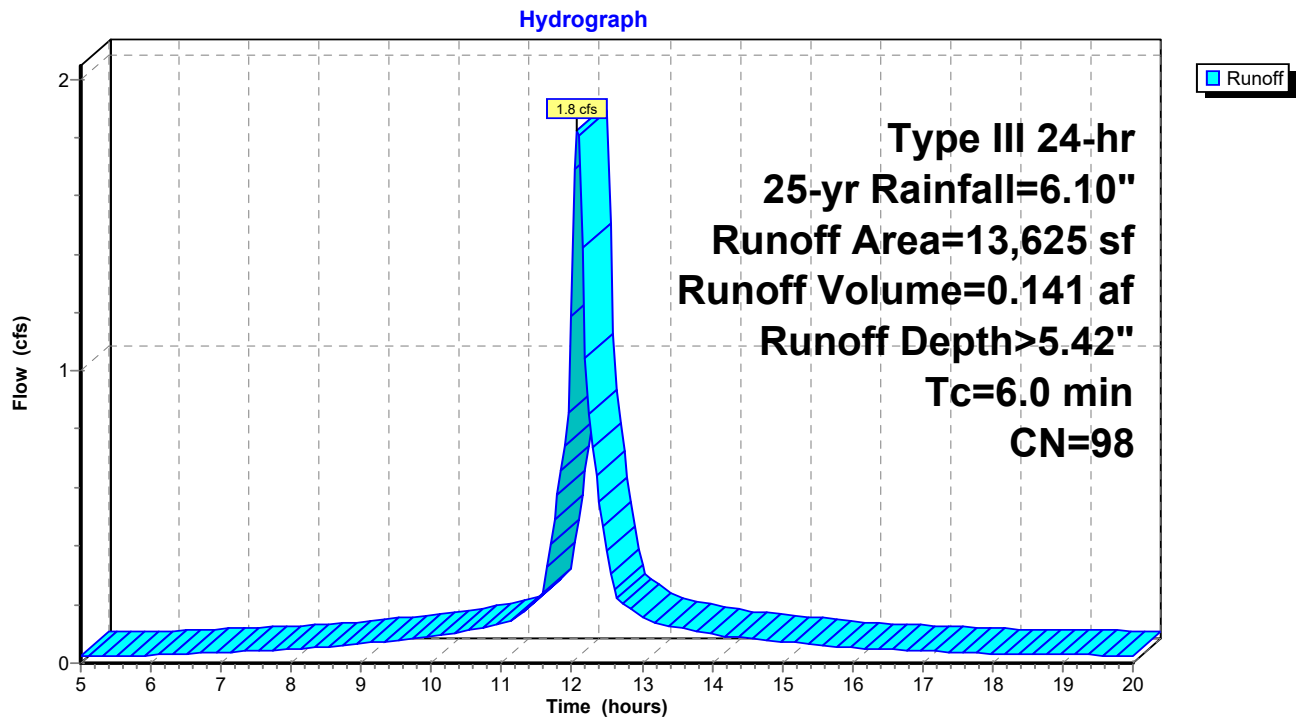
Runoff = 1.8 cfs @ 12.09 hrs, Volume= 0.141 af, Depth> 5.42"
Routed to Pond P1 : Subsurface Chambers (Cultec 902HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
13,625	98	Roofs, HSG D
13,625		100.00% Impervious Area

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

Subcatchment A2-PR: Roof Area



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Type III 24-hr 25-yr Rainfall=6.10"

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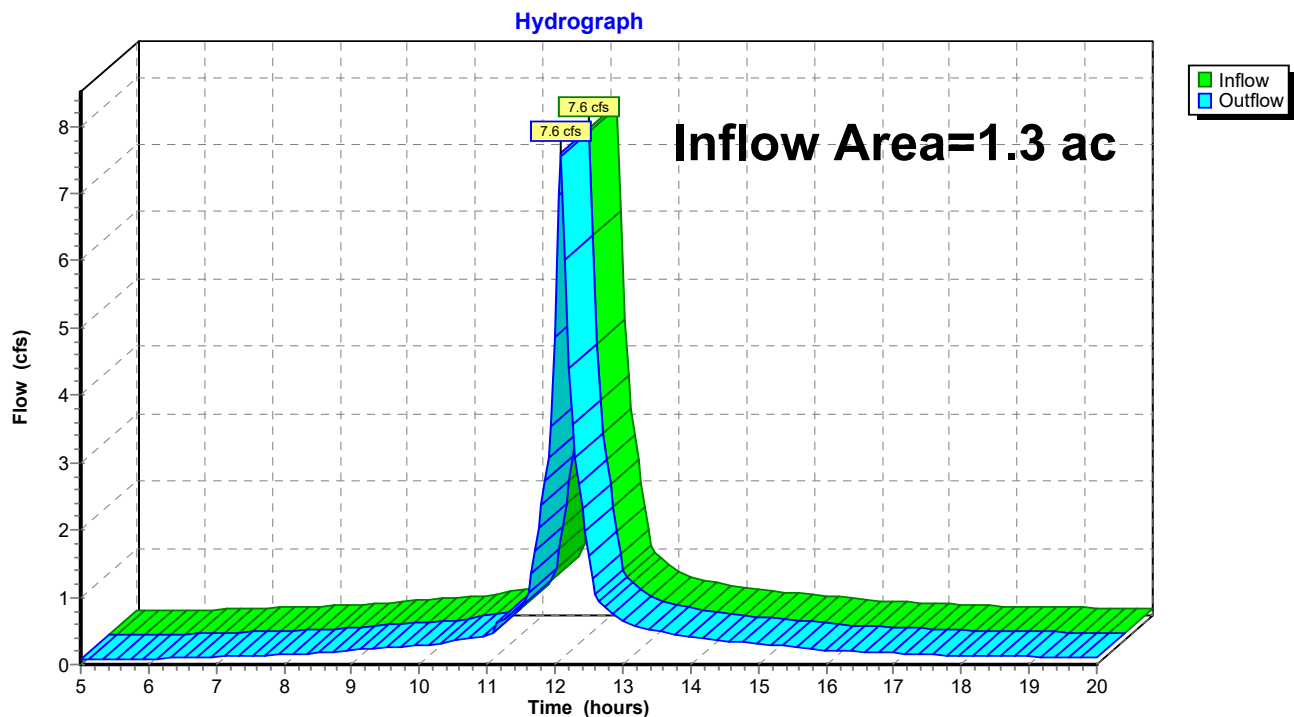
Summary for Reach A: Existing Catch Basin

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

Inflow Area = 1.3 ac, 98.24% Impervious, Inflow Depth > 5.15" for 25-yr event
Inflow = 7.6 cfs @ 12.09 hrs, Volume= 0.559 af
Outflow = 7.6 cfs @ 12.09 hrs, Volume= 0.559 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin



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Type III 24-hr 25-yr Rainfall=6.10"

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Summary for Pond P1: Subsurface Chambers (Cultec 902HD)

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.3 ac, 100.00% Impervious, Inflow Depth > 5.42" for 25-yr event
Inflow = 1.8 cfs @ 12.09 hrs, Volume= 0.141 af
Outflow = 1.8 cfs @ 12.10 hrs, Volume= 0.112 af, Atten= 0%, Lag= 0.5 min
Primary = 1.8 cfs @ 12.10 hrs, Volume= 0.112 af
Routed to Reach A : Existing Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 68.44' @ 12.10 hrs Surf.Area= 421 sf Storage= 1,347 cf

Plug-Flow detention time= 108.6 min calculated for 0.112 af (79% of inflow)
Center-of-Mass det. time= 52.6 min (786.7 - 734.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.00'	682 cf	9.50'W x 44.37'L x 5.75'H Field A 2,424 cf Overall - 718 cf Embedded = 1,706 cf x 40.0% Voids
#2A	63.75'	718 cf	Cultec R-902HD x 11 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf
		1,400 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	12.0" Round Culvert L= 58.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 67.00' / 66.40' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	68.00'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s) 4.0' Crest Height
#3	Device 1	68.50'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.8 cfs @ 12.10 hrs HW=68.43' (Free Discharge)

- 1=Culvert (Passes 1.8 cfs of 2.9 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Weir Controls 1.8 cfs @ 2.18 fps)
- 3=Broad-Crested Rectangular Weir (Controls 0.0 cfs)

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Type III 24-hr 25-yr Rainfall=6.10"

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Pond P1: Subsurface Chambers (Cultec 902HD) - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger®902HD)

Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf

Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap

Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf

11 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 41.37' Row Length +18.0" End Stone x 2 = 44.37' Base Length

1 Rows x 78.0" Wide + 18.0" Side Stone x 2 = 9.50' Base Width

9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

11 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 1 Rows = 717.6 cf Chamber Storage

2,423.5 cf Field - 717.6 cf Chambers = 1,705.9 cf Stone x 40.0% Voids = 682.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,400.0 cf = 0.032 af

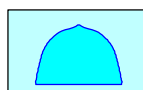
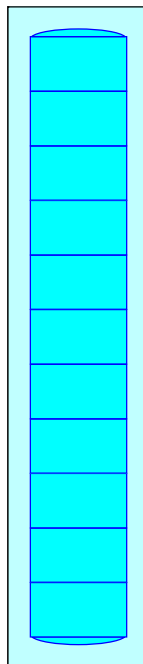
Overall Storage Efficiency = 57.8%

Overall System Size = 44.37' x 9.50' x 5.75'

11 Chambers

89.8 cy Field

63.2 cy Stone



342-782-Post Drainage Calcs

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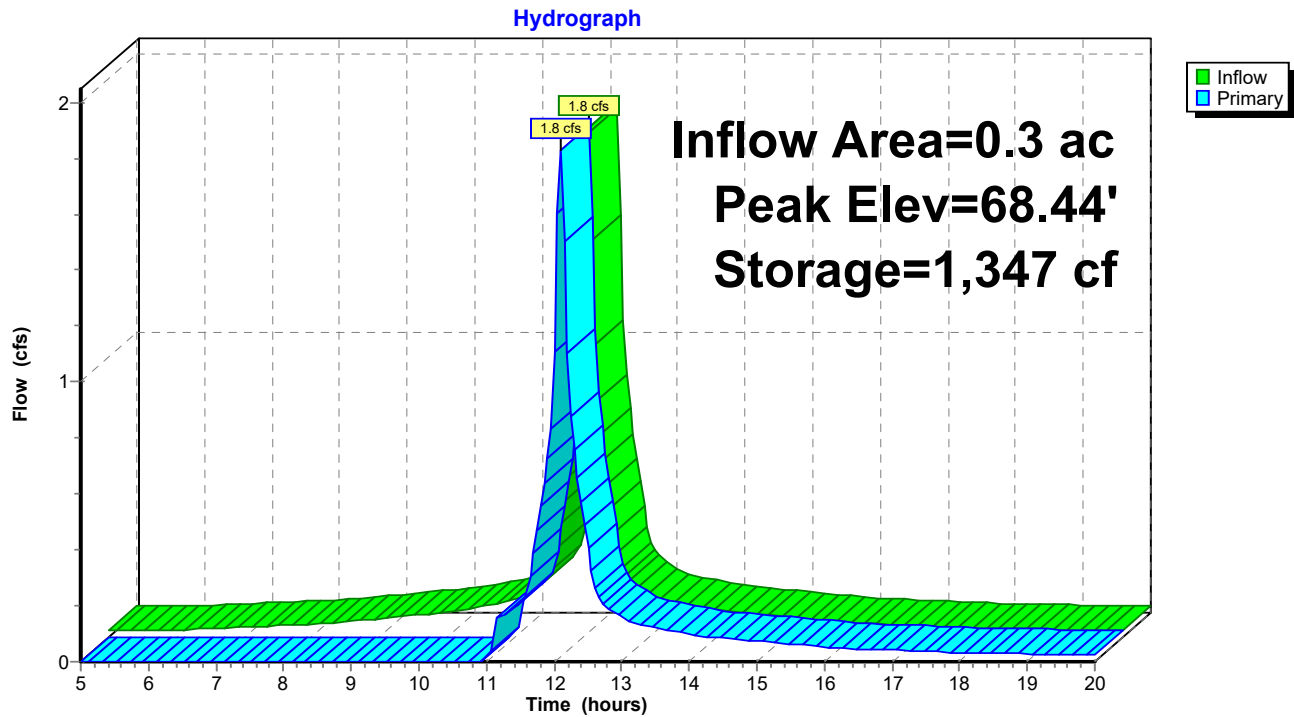
Storage Five Cranston

Type III 24-hr 25-yr Rainfall=6.10"

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Pond P1: Subsurface Chambers (Cultec 902HD)



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Storage Five Cranston

Type III 24-hr 25-yr Rainfall=6.10"

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Stage-Area-Storage for Pond P1: Subsurface Chambers (Cultec 902HD)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
63.00	0	65.55	671	68.10	1,290
63.05	8	65.60	685	68.15	1,299
63.10	17	65.65	700	68.20	1,307
63.15	25	65.70	714	68.25	1,316
63.20	34	65.75	729	68.30	1,324
63.25	42	65.80	743	68.35	1,333
63.30	51	65.85	758	68.40	1,341
63.35	59	65.90	772	68.45	1,349
63.40	67	65.95	786	68.50	1,358
63.45	76	66.00	801	68.55	1,366
63.50	84	66.05	815	68.60	1,375
63.55	93	66.10	829	68.65	1,383
63.60	101	66.15	843	68.70	1,392
63.65	110	66.20	857	68.75	1,400
63.70	118	66.25	871		
63.75	126	66.30	885		
63.80	142	66.35	899		
63.85	157	66.40	913		
63.90	173	66.45	927		
63.95	188	66.50	940		
64.00	204	66.55	954		
64.05	219	66.60	967		
64.10	235	66.65	981		
64.15	250	66.70	994		
64.20	265	66.75	1,007		
64.25	281	66.80	1,020		
64.30	296	66.85	1,033		
64.35	311	66.90	1,046		
64.40	327	66.95	1,058		
64.45	342	67.00	1,071		
64.50	357	67.05	1,083		
64.55	372	67.10	1,095		
64.60	388	67.15	1,108		
64.65	403	67.20	1,119		
64.70	418	67.25	1,131		
64.75	433	67.30	1,143		
64.80	448	67.35	1,154		
64.85	463	67.40	1,165		
64.90	478	67.45	1,175		
64.95	493	67.50	1,186		
65.00	508	67.55	1,195		
65.05	523	67.60	1,205		
65.10	538	67.65	1,214		
65.15	553	67.70	1,223		
65.20	568	67.75	1,231		
65.25	582	67.80	1,240		
65.30	597	67.85	1,248		
65.35	612	67.90	1,257		
65.40	627	67.95	1,265		
65.45	641	68.00	1,274		
65.50	656	68.05	1,282		

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Storage Five Cranston

Type III 24-hr 100-yr Rainfall=8.70"

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Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentA1-PR: Flow to existing

Runoff Area=43,075 sf 97.68% Impervious Runoff Depth>7.78"

Tc=6.0 min CN=98 Runoff=8.3 cfs 0.641 af

SubcatchmentA2-PR: Roof Area

Runoff Area=13,625 sf 100.00% Impervious Runoff Depth>7.78"

Tc=6.0 min CN=98 Runoff=2.6 cfs 0.203 af

Reach A: Existing Catch Basin

Inflow=10.9 cfs 0.814 af

Outflow=10.9 cfs 0.814 af

Pond P1: Subsurface Chambers (Cultec

Peak Elev=68.55' Storage=1,366 cf Inflow=2.6 cfs 0.203 af

Outflow=2.6 cfs 0.173 af

Total Runoff Area = 1.3 ac Runoff Volume = 0.844 af Average Runoff Depth = 7.78"

1.76% Pervious = 0.0 ac 98.24% Impervious = 1.3 ac

342-782-Post Drainage Calcs

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Summary for Subcatchment A1-PR: Flow to existing catch basin

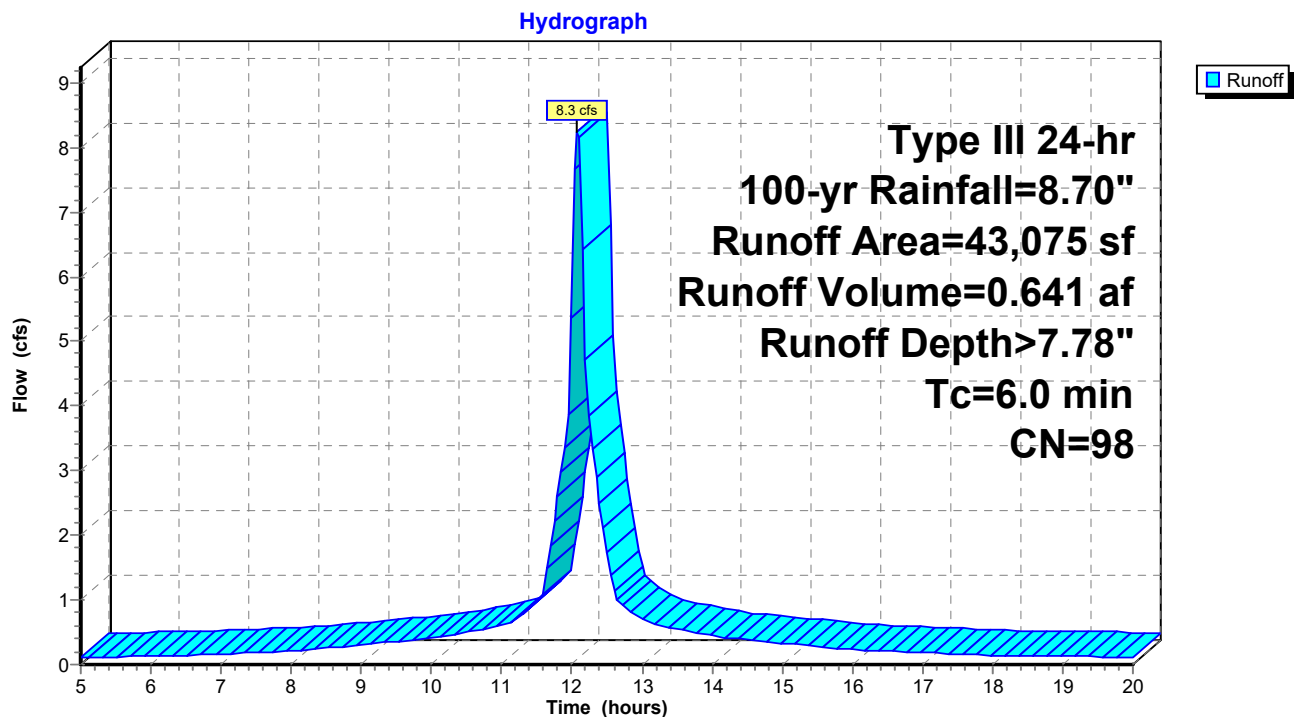
Runoff = 8.3 cfs @ 12.09 hrs, Volume= 0.641 af, Depth> 7.78"
Routed to Reach A : Existing Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.70"

Area (sf)	CN	Description
42,075	98	Paved parking, HSG D
1,000	80	>75% Grass cover, Good, HSG D
43,075	98	Weighted Average
1,000		2.32% Pervious Area
42,075		97.68% Impervious Area

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

Subcatchment A1-PR: Flow to existing catch basin



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Type III 24-hr 100-yr Rainfall=8.70"

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Summary for Subcatchment A2-PR: Roof Area

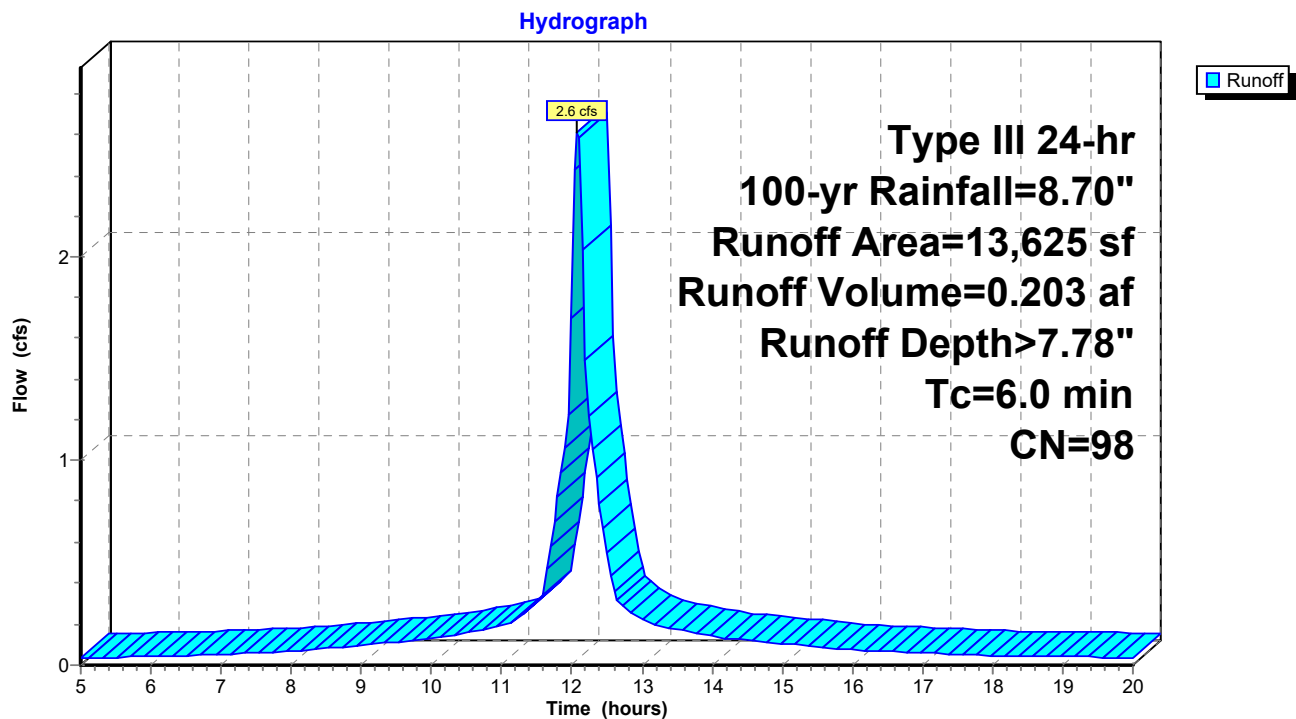
Runoff = 2.6 cfs @ 12.09 hrs, Volume= 0.203 af, Depth> 7.78"
Routed to Pond P1 : Subsurface Chambers (Cultec 902HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.70"

Area (sf)	CN	Description
13,625	98	Roofs, HSG D
13,625		100.00% Impervious Area

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

Subcatchment A2-PR: Roof Area



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Storage Five Cranston

Type III 24-hr 100-yr Rainfall=8.70"

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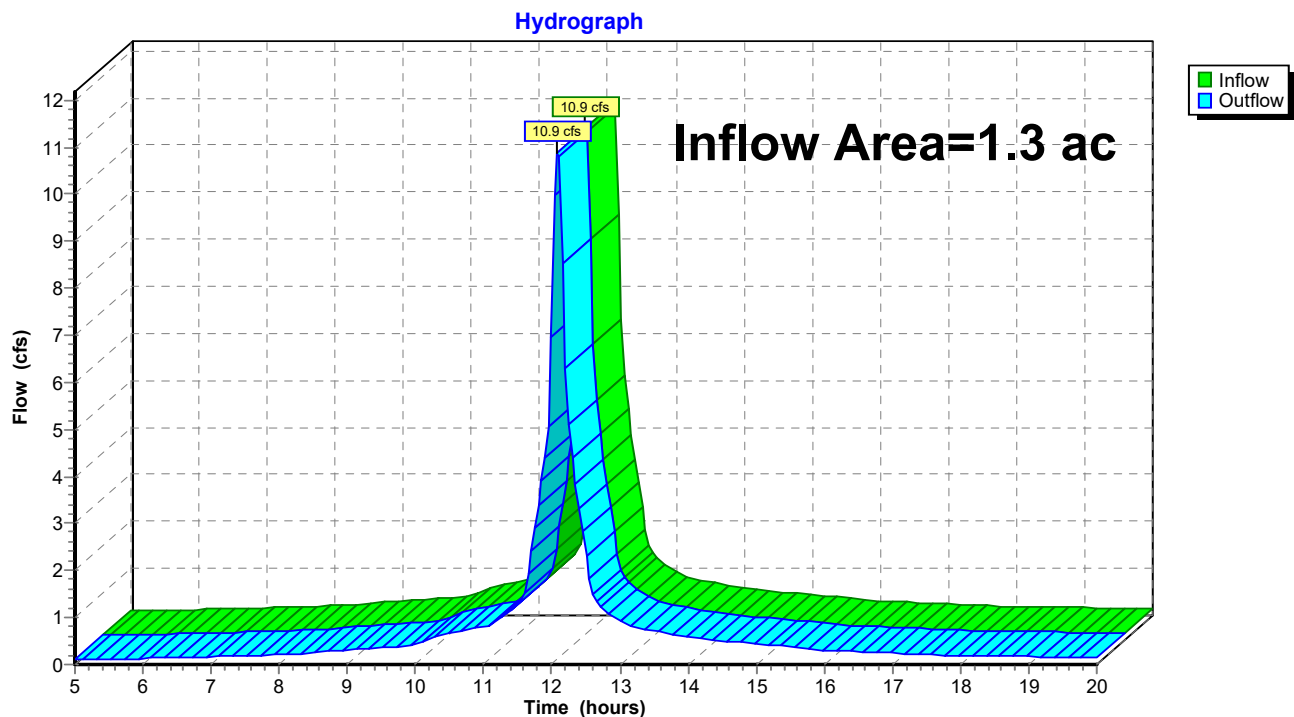
Summary for Reach A: Existing Catch Basin

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

Inflow Area = 1.3 ac, 98.24% Impervious, Inflow Depth > 7.51" for 100-yr event
Inflow = 10.9 cfs @ 12.09 hrs, Volume= 0.814 af
Outflow = 10.9 cfs @ 12.09 hrs, Volume= 0.814 af, Atten= 0%, Lag= 0.0 min

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

Reach A: Existing Catch Basin



342-782-Post Drainage Calcs

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Storage Five Cranston

Type III 24-hr 100-yr Rainfall=8.70"

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Summary for Pond P1: Subsurface Chambers (Cultec 902HD)

[82] Warning: Early inflow requires earlier time span

Inflow Area = 0.3 ac, 100.00% Impervious, Inflow Depth > 7.78" for 100-yr event
Inflow = 2.6 cfs @ 12.09 hrs, Volume= 0.203 af
Outflow = 2.6 cfs @ 12.09 hrs, Volume= 0.173 af, Atten= 0%, Lag= 0.5 min
Primary = 2.6 cfs @ 12.09 hrs, Volume= 0.173 af
Routed to Reach A : Existing Catch Basin

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 68.55' @ 12.09 hrs Surf.Area= 421 sf Storage= 1,366 cf

Plug-Flow detention time= 87.0 min calculated for 0.173 af (86% of inflow)
Center-of-Mass det. time= 42.2 min (775.0 - 732.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	63.00'	682 cf	9.50'W x 44.37'L x 5.75'H Field A 2,424 cf Overall - 718 cf Embedded = 1,706 cf x 40.0% Voids
#2A	63.75'	718 cf	Cultec R-902HD x 11 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf
		1,400 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	67.00'	12.0" Round Culvert L= 58.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 67.00' / 66.40' S= 0.0103 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 0.79 sf
#2	Device 1	68.00'	2.0' long x 0.50' rise Sharp-Crested Rectangular Weir 2 End Contraction(s) 4.0' Crest Height
#3	Device 1	68.50'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.6 cfs @ 12.09 hrs HW=68.54' (Free Discharge)

- 1=Culvert (Passes 2.6 cfs of 3.0 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir(Orifice Controls 2.5 cfs @ 2.60 fps)
- 3=Broad-Crested Rectangular Weir(Weir Controls 0.1 cfs @ 0.58 fps)

342-782-Post Drainage Calcs

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Pond P1: Subsurface Chambers (Cultec 902HD) - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger®902HD)

Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf

Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap

Cap Storage= 2.8 cf x 2 x 1 rows = 5.5 cf

11 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 41.37' Row Length +18.0" End Stone x 2 = 44.37' Base Length

1 Rows x 78.0" Wide + 18.0" Side Stone x 2 = 9.50' Base Width

9.0" Stone Base + 48.0" Chamber Height + 12.0" Stone Cover = 5.75' Field Height

11 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 1 Rows = 717.6 cf Chamber Storage

2,423.5 cf Field - 717.6 cf Chambers = 1,705.9 cf Stone x 40.0% Voids = 682.4 cf Stone Storage

Chamber Storage + Stone Storage = 1,400.0 cf = 0.032 af

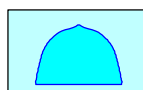
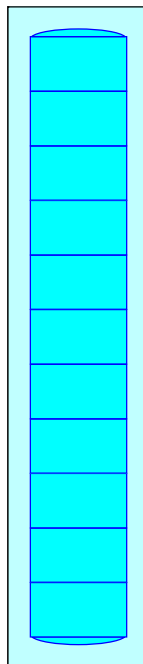
Overall Storage Efficiency = 57.8%

Overall System Size = 44.37' x 9.50' x 5.75'

11 Chambers

89.8 cy Field

63.2 cy Stone



342-782-Post Drainage Calcs

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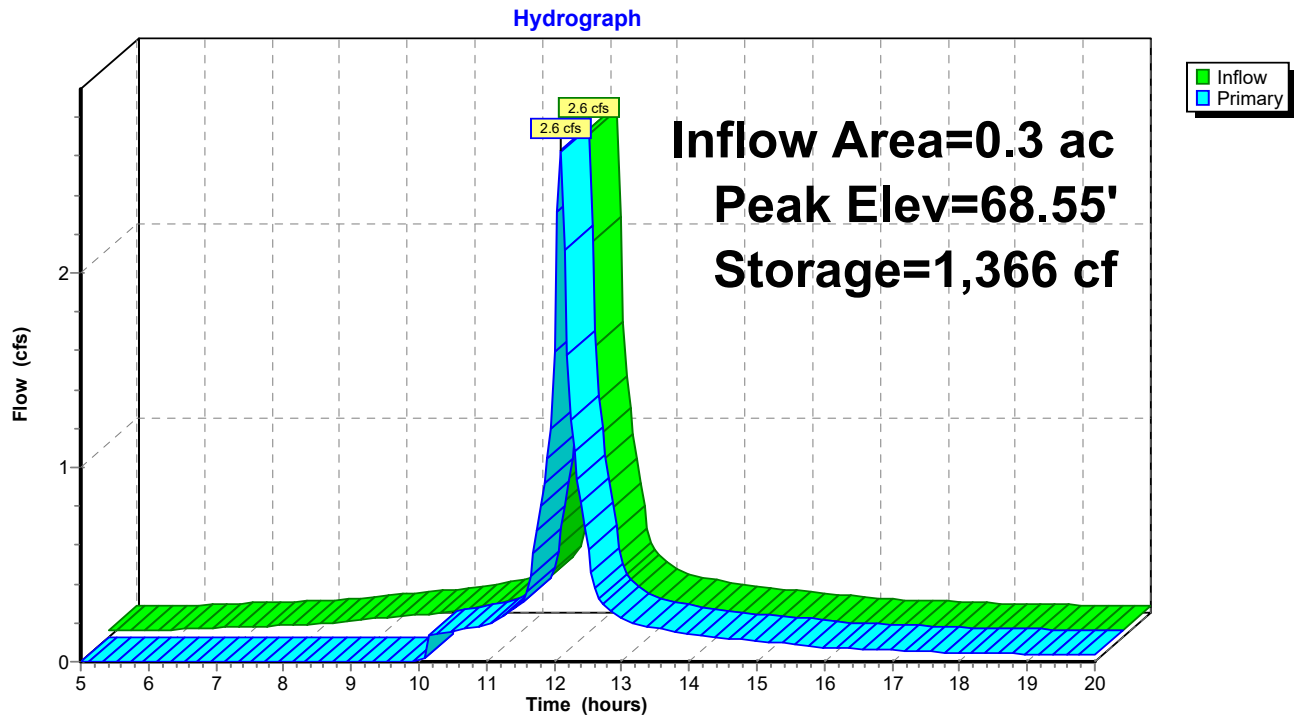
Storage Five Cranston

Type III 24-hr 100-yr Rainfall=8.70"

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Pond P1: Subsurface Chambers (Cultec 902HD)



342-782-Post Drainage Calcs

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Storage Five Cranston

Type III 24-hr 100-yr Rainfall=8.70"

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Stage-Area-Storage for Pond P1: Subsurface Chambers (Cultec 902HD)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
63.00	0	65.55	671	68.10	1,290
63.05	8	65.60	685	68.15	1,299
63.10	17	65.65	700	68.20	1,307
63.15	25	65.70	714	68.25	1,316
63.20	34	65.75	729	68.30	1,324
63.25	42	65.80	743	68.35	1,333
63.30	51	65.85	758	68.40	1,341
63.35	59	65.90	772	68.45	1,349
63.40	67	65.95	786	68.50	1,358
63.45	76	66.00	801	68.55	1,366
63.50	84	66.05	815	68.60	1,375
63.55	93	66.10	829	68.65	1,383
63.60	101	66.15	843	68.70	1,392
63.65	110	66.20	857	68.75	1,400
63.70	118	66.25	871		
63.75	126	66.30	885		
63.80	142	66.35	899		
63.85	157	66.40	913		
63.90	173	66.45	927		
63.95	188	66.50	940		
64.00	204	66.55	954		
64.05	219	66.60	967		
64.10	235	66.65	981		
64.15	250	66.70	994		
64.20	265	66.75	1,007		
64.25	281	66.80	1,020		
64.30	296	66.85	1,033		
64.35	311	66.90	1,046		
64.40	327	66.95	1,058		
64.45	342	67.00	1,071		
64.50	357	67.05	1,083		
64.55	372	67.10	1,095		
64.60	388	67.15	1,108		
64.65	403	67.20	1,119		
64.70	418	67.25	1,131		
64.75	433	67.30	1,143		
64.80	448	67.35	1,154		
64.85	463	67.40	1,165		
64.90	478	67.45	1,175		
64.95	493	67.50	1,186		
65.00	508	67.55	1,195		
65.05	523	67.60	1,205		
65.10	538	67.65	1,214		
65.15	553	67.70	1,223		
65.20	568	67.75	1,231		
65.25	582	67.80	1,240		
65.30	597	67.85	1,248		
65.35	612	67.90	1,257		
65.40	627	67.95	1,265		
65.45	641	68.00	1,274		
65.50	656	68.05	1,282		

Water Quality Volume Calculations



Water Quality Volume Flow Rate Calculations

Project Name: Cranston Self Storage
Project Location: 1 Kenney Drive
Project Number: 342-782

Date: 9/24/2024
Calculated By: CJV
Checked By: MB

Structure Name: P1
Subcatchment: A2-PR

Description: Cultec 902HD Chambers

Required WQv = (Required Treatment Depth) (I) / 12 in/ft

I = Impervious Area = STA = 27,141 sq ft
0.62 ac

Required Treatment Depth = 1.0 in

Required Water Quality Volume for 1" Treatment Depth:	2,262	cf
	0.05	ac ft

Required Treatment Depth = 0.5 in

Required Water Quality Volume for 0.5" Treatment Depth:	1,131	cf
	0.03	ac ft

Relief is requested to utilize treatment depth of 0.5 inches.

Provided Water Quality Volume

Bottom Area of System: 423 sq ft
Low Flow Outlet Elevation: 68 ft
**Water Quality Volume Provided: 1,274 cu ft

Provided Water Quality Volume:	1,274	cf
	0.03	ac ft

(**See attached documentation.)

*Stormwater Treatment Area Calculated Per Section 3.1.6.2 of the RISDISM Redevelopment Guidance.

Groundwater Recharge Calculations



Groundwater Recharge Calculations

Project Name: Cranston Storage Five
Project Location: 1 Kenney Drive
Project Number: 342-782

Date: 9/24/2024
Calculated By: CJV
Checked By: MB
1 of 2

Required Recharge Volume (Rev)

$Rev = (1")(F)(I) / 12$
F (recharge factor) = 0.1 in *assuming HSG D due to urban fill*
I (impervious area, acres) = STA = 0.64 ac
Rev Required = 0.005 ac-ft
Rev Required = 218 cf

Stormwater Treatment Area (STA) Calculation

per Section 3.2.6 of the RISDISM Redevelopment Criteria Guidance

Is this a redevelopment that disturbs > 10,000 SF? Yes

Is the site greater than 40% impervious in its existing condition? Yes

Existing Impervious Area = 3.87 ac

Existing Parcel Area (Site Size) = 6.68 ac

Existing % Impervious = 58%

All disturbed existing impervious area requires 50% treatment, new impervious area requires 100% treatment, and new pervious area can be subtracted out.

Disturbed Impervious Area - New Pervious Area = 1.28 ac

New Impervious Area = 0.00 ac

STA = 50% * Disturbed Impervious Area - New Pervious Area + 100% * New Impervious Area = 0.64 ac

Required Recharge Volume: 218 cu ft

Provided Recharge Volume

Pond P1 1,274 cf Cultec 902HD

TOTAL 1,274 cf

Provided Recharge Volume: 1,274 cu ft

APPENDIX C

OPERATIONS AND MAINTENANCE (O&M) PLANS

Construction Period Pollution Prevention and Sedimentation and Erosion Control Plan
Operations and Maintenance (O&M) Plan

**Construction Period Pollution Prevention and Sedimentation and Erosion
Control Plan**

**CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION
AND SEDIMENTATION CONTROL PLAN**

**PROPOSED SELF STORAGE
1 KENNEY DRIVE & O SHARPE STREET
CRANSTON, RHODE ISLAND 02920**

Applicant:

**STORAGE FIVE DEVELOPMENT
P.O BOX 1042
SEABROOK, TX 77586**

Prepared By:

**CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
31 BELLOWS ROAD
RAYNHAM, MASSACHUSETTS 02767**

CEC Project 342-782

SEPTEMBER 2024



Civil & Environmental Consultants, Inc.

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GENERAL

The greatest potential for sediment generation will occur during construction. An extensive erosion and sedimentation control program is proposed and will be diligently implemented during construction of the Project. The erosion control program will minimize erosion and sedimentation that could potentially impact resource areas. Water quality will be maintained by minimizing erosion of exposed soils and siltation. Erosion control barriers will be installed and exposed soil areas revegetated as soon as possible after work in an area is completed.

This Erosion and Sedimentation Control Plan includes preliminary measures and requirements for management and implementation of erosion and sediment controls during construction.

Responsible Party for Plan Compliance: Storage Five Development (Owner)

Emergency Contact Information:

To be determined.

CONSTRUCTION PHASE EROSION CONTROL MEASURES

The adjacent properties will be protected during construction by implementing siltation control measures, including the placement of compost silt socks as close as feasible to the down gradient limit of construction activity. Silt sacks will be installed in down gradient catch basins and a temporary stabilized construction exit will be constructed. The project may also implement other stabilization methods such as erosion netting and hydro seeding.

Short and Long Term Goals and Criteria

Short and long-term goals will include a variety of stabilizing sediment and erosion controls around the limit of work. All construction-phase erosion and sediment controls have been designed to retain sediment on-site to the extent practicable and limit runoff and the discharge of pollutants (sediment) from exposed areas of the Site.

All control measures will be installed and maintained in accordance with the manufacturer's specifications and good engineering practices. Weekly inspections and routine monitoring will be used to determine the effectiveness of controls in use.

Litter and solid construction debris potentially exposed to the stormwater will be prevented from becoming a pollution source through routine monitoring and the use of laborers to "pick" as necessary.

Stabilization Practices

The construction site activities will include numerous stabilizing practices. Sediment and erosion controls such as erosion netting, mulching and hydro-seeding may act as interim practices. Erosion netting material may include single net straw blankets or coconut blankets. Permanent stabilization practices will include the use of a hydro-seeding over vegetative support soil where additional exposure threatens stormwater quality. Seeding will be carried out with a seed mixture equal to the "Roadside Slope Mix" included below. All siltation barriers will remain in place until all exposed areas are re-vegetated.

Planting Schedule for Exposed Areas

1. All exposed areas will receive 6 inches of topsoil or compost material.
2. Seed will be equal to "Roadside Slope Mix" as specified by the Mass. Highway Department. Please refer to chart below for specifications. This mixture will be spread at a rate of 5 pounds per 1,000 square feet.

TABLE 1 ROADSIDE SLOPE MIX			
Common Name	Germination Proportion	Purity Minimum	Minimum
Creeping Red Fescue	50%	85%	95%
Kentucky 3	30%	85%	95%
Domestic Rye	10%	90%	98%
Red Top	5%	85%	92%
Ladino Clover	5%	85%	96%

Structural Practices

Perimeter controls will consist of compost silt socks. In order to ensure effective performance, proper installation is required.

A temporary stabilized construction exit will be constructed. A cross slope will be placed at the entrance to direct runoff to the settling area. If deemed necessary after construction begins, a wash pad may be included to wash off vehicle wheels before leaving the Site. Silt sacks will be installed in down gradient catch basins in order to capture sediment prior to stormwater entering the municipal drainage systems.

NON-STRUCTURAL CONTROLS

Good Housekeeping

Non-structural controls are as effective as structural controls in sediment control. Non-structural controls to be used at the construction Site include:

- Regular sweeping of paved surfaces; and
- Prompt cleanup of any waste or spilled waste materials.

Exposure Minimization

Exposure will be minimized by providing both permanent and temporary soil stabilization (see Section 5.2.2) over areas that have been completely constructed, or areas that will not be revisited within a 30-day period.

Where practicable, industrial materials and activities will be protected from exposure to rain, snow, snowmelt, or runoff.

Preventative Maintenance

A preventative maintenance program includes the timely inspection and maintenance of stormwater management devices. Examples of preventative maintenance include:

- Removal of obstructions, if any, from inlets and outlets.
- Removal of accumulated sediment and vacuuming water from sumps.
- Repairing and re-planting slope areas that experience erosion.

Inspections

An experienced Construction Monitor will conduct inspections of construction areas once every 7 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater, or the occurrence of runoff from snowmelt sufficient to cause a discharge. Storm event information from a weather station representative of the Site's location may be used to determine if a storm event of 0.25 inches or greater has occurred on the Site. Total rainfall will be measured for any

day of rainfall during normal business hours that measures 0.25 inches or greater. Construction areas an experienced Construction Monitor will inspect include:

- Disturbed areas of the construction Site that have not been finally stabilized,
- Areas used for storage of materials that are exposed to precipitation,
- Structural control measures,
- Locations where vehicles enter or exit the Site, and
- The stormwater management system and discharge outlets.

Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system.

Sediment and erosion control measures identified will be observed to ensure that they are operating correctly. The discharge locations or points will be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the Site will be inspected for evidence of offsite sediment tracking.

Based on the results of these routine inspections, the Contractor will correct any deficiencies found as soon as practicable. Results of the inspections, corrective actions taken in response to any deficiencies, and any opportunities for improvement that are identified will be documented in an inspection report.

RECORDKEEPING

The following records will be maintained on the Site:

1. Dates when major grading activities occur,
2. Dates when construction activities temporarily or permanently cease on a portion of the Site,
3. Dates when stabilization measures are initiated, and
4. In addition, the following records will also be kept:
 - The Order of Conditions; and any additional permit conditions/approvals,
 - All inspection reports, and
 - Any spill reports.

Operations and Maintenance (O&M) Plan

OPERATIONS AND MAINTENANCE (O&M) PLAN

**PROPOSED SELF STORAGE
1 KENNEY DRIVE & O SHARPE STREET
CRANSTON, RHODE ISLAND 02920**

Applicant:

**STORAGE FIVE DEVELOPMENT
P.O BOX 1042
SEABROOK, TX 77586**

Prepared By:

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CEC Project 342-782

SEPTEMBER 2024



Civil & Environmental Consultants, Inc.

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GENERAL

Stormwater management systems with multiple components, such as the one proposed for the project, assures the cleanest possible discharges of stormwater to the environment. However, these systems must be routinely maintained to keep them in good working order. Additionally, this plan identifies potential sources of pollution that may affect the quality of stormwater discharges and describes the implementation of Long-Term Pollution Prevention practices to reduce potential pollutants in stormwater discharge. The party identified below will be responsible for the operation and maintenance of the stormwater management system and Site. Schedules and procedures for inspection and maintenance of the existing and proposed stormwater management system components are provided in the following sections.

Responsible Party for Plan Compliance:

Upon a transfer of ownership, the future owner shall assume the responsibilities for compliance with this O&M Plan.

Emergency Contact Information:

To be determined.

Estimated O&M Budget

It is estimated that an annual budget of \$1,000 should be allocated to performing routine inspections and maintenance identified in this O&M Plan.

Employee Training

Training of personnel is essential to achieving proper operation and maintenance of the stormwater management system. Therefore, those Facility personnel who are responsible for operation and maintenance will be trained on the following subjects:

- Environmental laws and regulations relating to stormwater,
- The components and goals of the current Erosion and Sediment Control Plan,
- The components and goals of the current Spill Response Plan

- Site specific permit conditions and requirements,
- General Facility spill response procedures,
- General good housekeeping procedures, and
- General material management procedures.

Refresher training sessions will be held once a year following the completion of the Site Compliance Evaluation.

Record Keeping

Records of inspections and maintenance shall be up to date and available for review and inspection, if requested by the City's official.

STORMWATER BEST MANAGEMENT PRACTICES (BMP) PLAN

Routine Inspections

Inspections of the stormwater management system as a whole, and of the individual components of the system, will be carried out on a routine basis in accordance with the schedule identified in below in the Maintenance Plan Section. Components to be inspected include the trench drain and infiltration chambers. Each will be inspected for sediment buildup, presence of oil, color, and structural damage. The results of each inspection will be entered into an inspection log. Refer to Table 1 for the inspection log form.

Maintenance Plan

The Responsible Party will incorporate a routine maintenance program to assure proper operation of the stormwater management system. Maintenance will be performed based on the results of inspections in accordance with the schedules identified in Table 1. The program will include the following maintenance activities:

Roof Drain Leaders

- Perform routine roof inspections twice per year, typically in the spring and fall.
- Inspect for blockage and remove debris if required.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to authorized personnel.

Subsurface Stormwater Chambers

See the attached Manufacturer's instructions on operation and maintenance requirements and methodology.

- Perform routine inspections on a monthly basis for the first three months after installation. Then, at a minimum, the treatment structure is to be inspected twice annually and the infiltrating structure is to be inspected annually.

- The subsurface infiltration system will be inspected twice during for the first year and annually thereafter by removing the manhole/access port covers and determining the thickness of sediment that has accumulated.
- If sediment is more than two inches deep, it must be suspended via flushing with clean water and removed using a vacuum truck.
- Outlet pipe will be examined at least once each year and verified that no blockage has occurred.

LONG TERM POLLUTION PREVENTION MAINTENANCE

The Responsible Party will incorporate a routine maintenance program to ensure the continued effectiveness of the structural water quality controls. Maintenance will be performed based on the results of inspections in accordance with the schedules identified below. The program will include the following maintenance activities:

Maintenance of Pavement Systems

Regular maintenance of pavement surfaces will prevent pollutants such as oil and grease, trash, and sediments from entering the stormwater management system. The following practices should be performed:

- Sweep or vacuum asphalt pavement areas annually with a commercial cleaning unit and dispose of removed material.
- Routinely pick up and remove litter from the parking areas, islands, and perimeter landscaping.

Maintenance of Vegetated Areas

Proper maintenance of vegetated areas can prevent the pollution of stormwater runoff by controlling the source of pollutants such as suspended sediments, excess nutrients, and chemicals from landscape care products. Practices that should be followed under the regular maintenance of the vegetated landscape include:

- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.
- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- Grass vegetation should not be cut to a height less than four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application.

- Fertilizer usage should be avoided. If deemed necessary, slow release fertilizer should be used. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas, but should not be applied on a regular basis unless necessary.

Management of Snow and Ice

Should significant snow fall events occur, which result in stockpiled snow impacting the operation of the Project Site, through the temporary loss of parking or limiting access in any way, the property manager may choose to have snow removed from the site. All snow removal operations will be done in accordance with Massachusetts DEP guidelines BRPG01-01, effective date March 8, 2001.

Salt and Deicing Chemicals

The amount of salt and deicing chemicals to be used on the site shall be reduced to the minimum amount needed to provide safe pedestrian and vehicle travel. The following practices should be followed to control the amount of salt and deicing materials that come into contact with stormwater runoff:

- Devices used for spreading salt and deicing chemicals should be capable of varying the rate of application based on the site specific conditions.
- Sand and salt should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials.

ATTACHMENT 1

CONSTRUCTION BMP MAINTENANCE LOG



Project Name: Proposed Self Storage
Project Location: 1 Kenney Drive
Project Number: 342-782

Date: 9/13/2024
Prepared By: CJV
Approved By: MB

Table 1.1 - Stormwater Operations and Maintenance Log

Best Management Practice	Inspection Frequency	Date Inspected	Inspector	Minimum Maintenance and Key Items to Check	Cleaning or Repair Needed (List Items if Required)	Date of Cleaning or Repair	Performed by
Pavement Sweeping	Inspect quarterly.			Paved areas will be swept annually at a minimum, and as otherwise needed.			
Existing Catch Basin	Inspect four times per year. Clean four times per year, in the spring and fall, or whenever sediment buildup exceeds two (2) feet in depth.			Remove trash and deposits. During cleanings, confirm the oil/debris trap (hood) is installed properly, is free of clogs, and is functional. Reinstall or replace as needed. Take care not to damage the oil/debris trap (hood) during cleaning.			
Roof Drain Leaders	Inspect twice per year, typically in the spring and fall.			Inspect for blockage and remove debris if required.			
Subsurface Stormwater Chambers	Inspect monthly for the first three months. Then, at a minimum, the treatment structure is to be inspected twice annually and the infiltrating structure is to be inspected annually as required by the manufacturer.			Remove sediment once per year or when buildup exceeds two (2) inches in depth.			
Vegetated Areas	Inspect twice per year, typically in the spring and fall.			<p>Perform maintenance on a regular basis during the growing season. Mow grassed areas on a regular basis to maintain growth. Plant alternative mixture of grass species in the event of unsuccessful establishment. Grass vegetation should not be cut to a height less than six inches.</p> <p>Maintain planted areas adjacent to pavement to prevent soil washout and immediately clean any soil deposited on pavement. Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming.</p> <p>Remove trash, sediment debris and invasive vegetation.</p>			