

STORMWATER ANALYSIS
FOR
OAK STREET LOFTS
AT
9 OAKLAND ST. AMESBURY, MA 01913

PREPARED ON

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1. Project Description

1.1. Introduction

9 Oakland Street LLC (The Applicant) is proposing to redevelop three abandoned structures from industrial use to commercial/residential mixed-use, as well as construct a fourth structure to serve a parking garage for the redevelopment. The applicant has retained the services of Millennium Engineering Inc. (MEI) for civil engineering services associated with the redevelopment, including the design of a stormwater management system and the preparation of this report.

The site is 9 Oakland St. in the City of Amesbury Massachusetts. There are two parcels linked to this address, numbered 94 and 95 on Map 53 of the local assessor's maps. The purpose of this report is to explain the design of the proposed development's stormwater management system and document the system's compliance with State and Municipal regulations.

1.2. Existing Conditions

This section will describe the project site in its current state.

1.2.1. Topography & Natural Resources

The site can be described as urban landscape with decades of prior development. Having been built onto the side of a hill, both flat and steep grades are present, with little to no transition between the two, aside from retaining walls. No natural resources such as wetlands protected habitats are known to exist on the site.

1.2.2. Existing Structures & Use

Three structures exist on the site, all of which are rectangular brick buildings that were originally constructed as industrial mills. The buildings are currently abandoned, and efforts to clean them up so that they can be redeveloped are underway. Volatile Organic Compounds (VOC's) were detected in the soil beneath these buildings, and a monitoring and remediation program has been in place for almost a decade. More information on this can be found online at the Massachusetts Department of Environmental Protection website using the link below, under the Release Tracking Number (RTN) 3-0032360.

<https://eeaonline.eea.state.ma.us/portal#!/search/wastesite>

1.2.3. Utilities

The site is surrounded by gas, electricity, water, sewer, and storm drain utilities, and service connections for electric, water and sewer have been identified on record plans. It is not known if these connections are still in use.

1.3. Proposed Conditions

This section will describe all proposed changes to the project site.

1.3.1. Alterations to Topography & Natural Resources

In general, the project does not propose significant changes to the grading of the site. The new parking garage will be built into the steepest parts of the site, replacing the sites only patch of

woods. The only other topographical changes will be the conversion of some of the sites paved areas to lawns and landscaped areas.

1.3.2. Proposed Structures & Use

As alluded to previously, The Applicant intends to redevelop the site into a mixed use of residential and commercial. New construction will include lawn, landscaped areas, patios, a parking garage, and fresh pavement where the parking lot and sidewalk have deteriorated.

1.3.3. Proposed Utilities

At the time of this report, project proposes the reactivation of electric, water, and sewer services, and the project's stormwater management system will discharge directly to the municipal storm drain system. It is not known if there is a combined sewer overflow downstream of where the proposed sewer and storm drain service lines connect to the municipal main lines.

2. Stormwater Management

2.1. Hydrology

This section will describe the existing hydrologic characteristics of the watershed in which the site is located as relevant to stormwater management.

2.1.1. Rainfall

State and Municipal regulations require use of the latest available rainfall data for the 2-, 10-, 25-, and 100-year, 24-hr rain events. The rainfall depth for each of these events was taken from data published by the Natural Resource Conservation Service (NRCS) based on Atlas-14 Volume 10. Table 1 below summarizes the rainfall depth for each storm.

Table 1: Recurrence & Depth of Design Storms

Recurrence Interval	Rainfall Depth (in.)
2-year	3.24
10-year	5.12
25-year	6.30
100-year	8.11

2.1.2. Soils

Soil Boring Logs recorded between December 2014 and August 2017 by Soil Exploration Corp., and Clean Soils Environmental LTD., were used to determine the composition of the soils at the project site. Copies of these logs have been included with this report as Attachment 2). The logs revealed that the sand and inorganic silt make up the majority of the soil beneath the site, with the former being the more prevalent of the two. For this reason, the stormwater model uses hydrologic soil group A (HSG A) for the whole of the site.

On March 5th, 2026, four additional test pits were dug near the locations of the proposed infiltration chambers, and one infiltration test was conducted in each pit with a double ring infiltrometer. The tests revealed that the soils within the footprint of the chambers beneath the proposed parking lot had an average infiltration rate of 9.25 in/hr, and the soils within the footprint of the chambers beneath the garage have an average infiltration rate of 52.5 in/hr. The test pit and infiltrometer logs are included in Attachment 3. When designing infiltration systems,

MADEP guidance allows the use of up to 50% of the average infiltration rate determined by double ring infiltrometer. Therefore, the chambers beneath the garage were designed with an infiltration rate of 25 in/hr. and the chambers beneath the parking lot were designed around a rate of 4 in/hr.

2.1.3. Pre-Development Subcatchments

Under Pre-Development conditions, the site was modelled as a six subcatchments draining to four different design points. Normally, only 4 subcatchments would have been delineated, however, the additional catchments needed to be broken out in order to quantify the amount of runoff flowing onto abutting lots. Since each design point represents a different structure in the same municipal storm drain network, outflow from each point is routed to the next downstream design point, with a lag time that was calculated based on pipe flow.

Design Point 1 is a catch basin on Oakland St. called out on the plans as CB 2. This basin collects runoff from the parking lot and over half of the roof area of the existing buildings. Runoff collected by CB 2 is discharged to DP3 via the municipal storm drain system.

Design Point 2 measures runoff flowing onto an abutting lot identified as lot 97 by the assessor's maps. This point collects flow from the southerly facing roofs, a patch of woods, and some of the runoff that flows onto the site's easterly abutter, identified as lot 214 by the assessor's maps. It should be noted that runoff flowing onto lot 214 could not be measured by a single design point because there is a high point along the lot line that divides the drainage area, directing runoff toward DP1 and DP2. To properly quantify the flow onto lot 214, add the outflow hydrographs of nodes S2A and S2B from the HydroCAD model.

Design Point 3 is the drain manhole called out on the plans as DMH 3. This point measures all of the flow from design point 1 and runoff from the perimeter and roof of the building closest to the corner of Oakland and Chestnut Streets. All runoff collected by this point is discharged to the next manhole, DMH 4, which is also Design Point 4.

Design Point 4 is the drain manhole called out on the plans as DMH 4. This manhole collects runoff from the remains of a concrete loading dock along Chestnut St. as well as the discharge from design points 2 and 3. This point is the final destination of all runoff from the site, and it is where the pre- and post-development flow rates will be compared for regulatory compliance.

Of the site's 1.259 acres, 69.9% is covered by impervious surfaces such as pavement, sidewalks, and roofs. This results in a higher peak runoff rate despite the soil's conduciveness to drainage and infiltration. The remainder of the site is covered by lawns, a single patch of woods, and bare earth; the former two of which are in good condition. A visual of the subcatchment boundaries and flow paths are provided in Attachment 3), and a summary of the total area and the amount of impervious surface are provided by Table 2 below.

Table 2: Pre-Development Subcatchment Summary

Subcatchment Number	Receiving Design Point	Impervious Surface (acres)	Total Area (acres)
S1	DP1	0.458	0.458
S2A	DP2	0.053	0.062
S2B	DP2	0.039	0.041
S2C	DP1	0.099	0.404
S3	DP3	0.123	0.123
S4	DP4	0.108	0.171

Subcatchment Number	Receiving Design Point	Impervious Surface (acres)	Total Area (acres)
Total	-	0.880	1.259

2.1.4. Post-Development Subcatchments

In post-development, the drainage area is further divided into 9 subcatchments that are collected by the same four design points. Table 3 below summarizes the new subcatchments. The location and routing of the four design points are unchanged from their pre-development versions.

Design Point 1 collects treated runoff from the parking lot, and it collects untreated runoff from the lawn along the easterly lot line, and the sidewalk/landscaped area along Oakland St. The area draining to this point was reduced from 0.519 acres to 0.304 acres, and the amount of impervious surface draining to this point is reduced from 0.512 acres to 0.247 acres.

Design Point 2 collects only untreated runoff from the lawns and stone dust path along the perimeter of the buildings as shown on the drainage plan included in Attachment 3). The area contributing to this design point is reduced from 0.446 acres to 0.024 acres, and the impervious surface draining to this point is reduced from 0.145 acres to 0 acres.

Design Point 3 collects untreated runoff from the corner of Oakland and Chestnut Streets in addition to all the runoff from Design Point 1. Total contributing area to this point decreases from 0.642 acres to 0.329 acres, and the total impervious surface decreases from 0.634 acres to 0.271 acres.

Finally, Design Point 4 collects treated runoff from the infiltration chamber beneath the garage, and all runoff from Design Points 2 and 3. Being the final design point in the series, the total contributing area of 1.259 acres remains unchanged from pre-development. The total impervious surface across the entire site changes from 0.880 acres to 1.150 acres.

Table 3: Post-Development Subcatchment Summary

Subcatchment Number	Receiving Design Point	Impervious Surface (acres)	Total Area (acres)
S1-1	DP1	0.239	0.284
S1-2	DP1	0.008	0.013
S2A-1	DP1	0.0	0.007
S2B-1	DP2	0.0	0.003
S2C-1	DP2	0.0	0.022
S3-1	DP3	0.023	0.025
S4-1	DP4	0.022	0.035
S4-2	DP4	0.837	0.837
S4-3	DP4	0.021	0.033
Total	-	1.150	1.259

2.1.5. Receiving Waters

As alluded to previously, runoff that is not infiltrated naturally or by design is received by a municipal storm drain network. While this is unconfirmed, it is assumed that this storm drain network discharges to nearby Plumbush Creek, located South of the site.

2.2. Compliance with Regulatory Standards

This section will describe how the project's stormwater management system (The System) will comply with the standards established by the Commonwealth of Massachusetts. Municipal standards will be cited where applicable.

2.2.1. Standard 1: Untreated Stormwater

As stated by Standard 1: *"No new stormwater conveyances (e.g. outfalls) will discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth."*

Of the 1.150 acres of the site's post-development impervious surface, 1.10 acres (95%), is treated by The System. See Table 5 below for a break-down of which subcatchments do and do not receive treatment for their impervious surfaces.

All runoff from the redeveloped site, whether it is or is not collected and treated by the stormwater management system, is discharged to a municipal storm drain system. Therefore, the redevelopment of this site complies with Standard 1 because the redeveloped site does not have, nor will it create an outfall which discharges untreated stormwater directly to the waters and wetlands of the Commonwealth.

2.2.2. Standard 2: Post-Development Peak Discharge Rates

As stated by Standard 2: *"Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates."*

The System has been designed to prevent the peak discharge rates of the 2-, 10-, 25, and 100-year rain events do not exceed their pre-development values. Table 4 below summarizes the peak flow rates under pre- and post-development conditions, as well as the pre- and post-development drainage area. To find out more about how these values were calculated, see Attachment 4).

Table 4: Pre- and Post-Development Peak Runoff Rates

Design Point	Total Drainage Area (Ac)		Peak Rates of Runoff (cfs)							
			2-Year		10-Year		25-Year		100-Year	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
DP1	0.519	0.304	1.57	0.31	2.52	1.13	3.11	1.45	4.01	1.82
DP2	0.446	0.024	0.12	0.05	0.27	0.09	0.41	0.12	0.87	0.16
DP3	0.642	0.329	1.96	0.34	3.13	1.22	3.86	1.57	4.99	1.98
DP4	1.259	1.259	2.31	2.03	3.90	3.63	5.06	4.40	6.94	6.76

All peak flows under post-development conditions are well below their pre-development values, therefore, this project meets Standard 2 to the maximum extent practicable.

2.2.3. Standard 3: Recharge to Groundwater

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

Under normal circumstances, the redevelopment would be required to recharge 0.6 inches multiplied by the difference between the existing and proposed impervious surfaces. However, this cannot be achieved due to the presence of contaminated soils and groundwater on the downgradient property. The applicant's Licensed Site Professional, Simmons Environmental Services, advised that infiltrating stormwater at this site could cause migration or exacerbation of current contamination downgradient of the site. This means that infiltrating stormwater runoff at this site risks spreading the that contamination. To prevent this from happening, the applicant is proposing to infiltrate less volume than would normally be required of this redevelopment.

According to Standard 3, MassDEP requires infiltration only to the maximum extent practicable for sites where recharge is proposed at or adjacent to an area classified as contaminated. Given the relatively small area of the site, there is no location on site where the full required recharge volume can be infiltrated. Instead, the applicant is proposing to infiltrate runoff from the courtyard and parking lot that faces Oakland Street using subsurface infiltration chambers beneath that courtyard. Additionally, the applicant has retained Simmons Environmental Services to provide consultation during construction, ensuring that the redevelopment is constructed in accordance with applicable regulations.

Table 5 below compares the recharge volume normally required by Standard 3 to the recharge volume proposed for the redevelopment. Simmons Environmental Services has reviewed the current proposal and has concluded that the proposal is compatible with ongoing monitoring and remediation efforts on site and the existing contamination on adjacent parcels.

Table 5: Required vs. Provided Recharge Volume

Existing Impervious Surface (ft ²)	Proposed Impervious Surface (ft ²)	New Impervious (ft ²)	Required Recharge Volume (ft ³)	Provided Recharge Volume (ft ³)
38,333	50,156	11,823	591	436

2.2.4. Standard 4: Removal of 80% of Total Suspended Solids

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

Most of the redevelopment's impervious surface is comprised of runner membrane roofing that does not require treatment for the removal of TSS. This leaves 12,709ft² of impervious surface that must be treated to the maximum extent practicable for the redevelopment to comply with Standard 4. As shown by Table 6 below, the redevelopment removes 73% of its TSS. This is the maximum extent to which TSS can be practically removed because the remaining untreated impervious surface cannot receive treatment without an unreasonably more intricate system of pipes and treatment structures.

Table 6: Summary of TSS Removed

Treatment Train	Impervious Surface Requiring Treatment (sq-ft)	TSS Removed (%)	Weighted Average of TSS Removed (%)
Courtyard & Parking Lot	10,418	89%	73%
Building Roofs*	0	0%	0%
Untreated	2,291	0%	0%
Total	12,709		73%

2.2.5. Standard 5: Land Uses with Higher Potential Pollutant Loads

Standard 5 states that “For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook.”

No new discharges with higher potential pollutant loads are associated with the proposed use.

Regarding the site’s previous industrial use and remediation efforts, the site’s Licensed Site Professional at Simmons Environmental Services has reviewed the current proposal and has concluded that the proposal is compatible with ongoing monitoring and remediation efforts on site (which are aimed at addressing VOCs in soils in portions of the site that will not be impacted by stormwater or the proposed infiltration) and the existing contamination on adjacent parcels. Therefore, the redevelopment meets Standard 5 to the maximum extent practicable.

2.2.6. Standard 6: Critical Areas

Standard 6 states that “Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas as provided in the Massachusetts Stormwater Handbook.”

The site is not located within Zone II or Interim Wellhead Protection Area of a Public Water Supply, nor will stormwater from the redevelopment be discharged to them. Therefore, Standard 6 is not applicable to this project.

2.2.7. Standard 7: Redevelopment

Standard 7 states that “A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5 and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions”

This project is a redevelopment of an existing site and is therefore subject to this standard. For information on how the redevelopment will meet the modified versions of Standards 1-6, please see their respective sections within this report.

2.2.8. Standard 8: Erosion & Sedimentation Controls

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

A plan for controlling erosion and sedimentation during construction will be submitted alongside the civil plans for the project. The plan will be appropriate for the type of work expected for this project; therefore, the redevelopment complies with Standard 8.

2.2.9. Standard 9: Operation & Maintenance Plans

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

A long-term operation and maintenance plan has been prepared for The System. Please see Attachment 5) for a copy of the plan. This plan covers all the BMP's associated with The System, thereby proving that the redevelopment complies with Standard 9.

2.2.10. Standard 10: Illicit Discharges to Drainage System

Standard 10 states: *“All illicit discharges to the stormwater management system are prohibited.”*

Given that remediation efforts at the site have been completed, and that the infiltration BMPs are well above the water table, no pollutants from the redevelopments previous use will enter The System as illicit discharges. Furthermore, access to the redevelopment's stormwater will be limited to authorized personnel only, thereby reducing the likelihood of illicit discharges to The System to the maximum extent practicable. An Illicit Discharge Compliance Statement shall be submitted by The Applicant to the permitting authority prior to the discharge of any stormwater to post-construction BMPs.

ATTACHMENT 1)

NRCS WEB SOIL SURVEY REPORT



United States
Department of
Agriculture

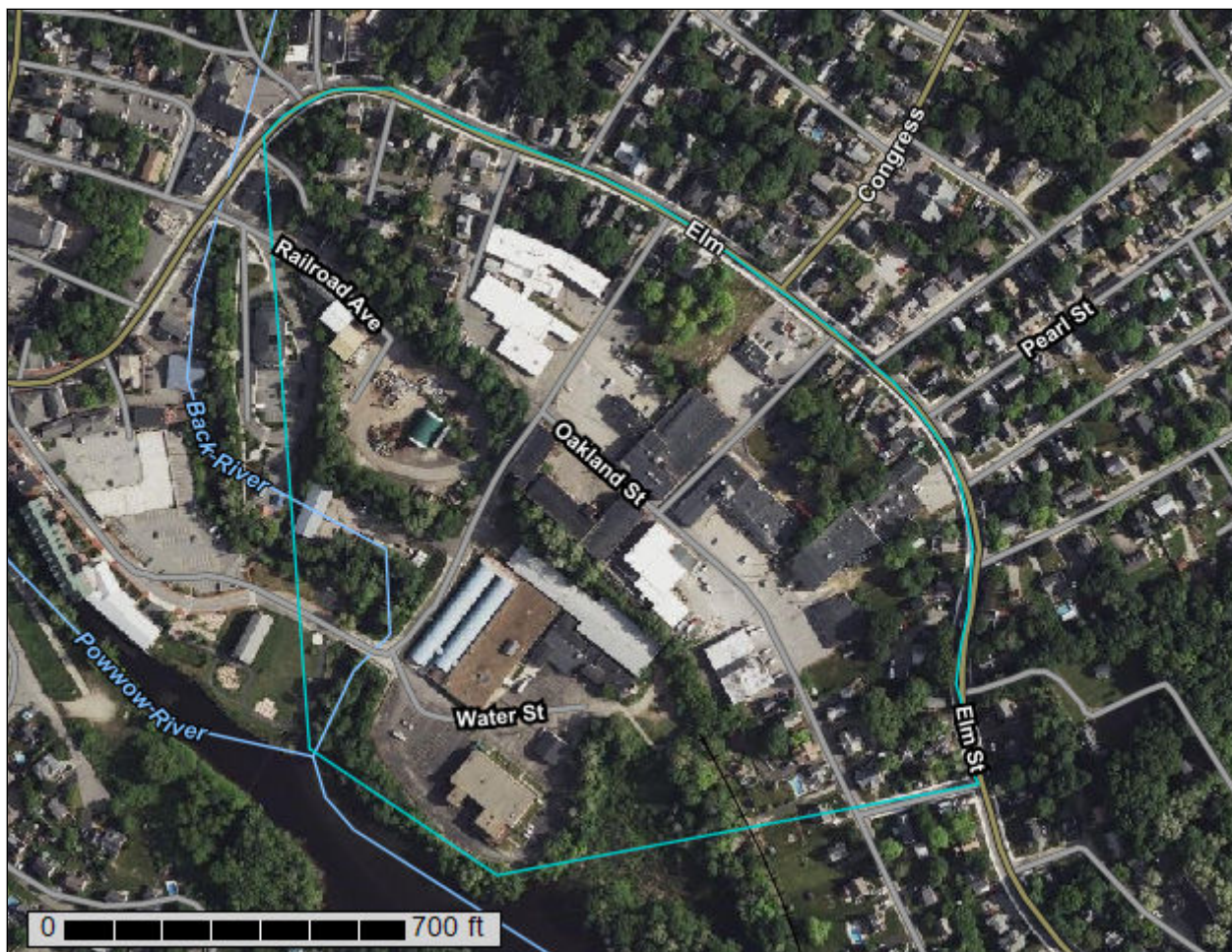
NRCS

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 **Essex County, Massachusetts, Northern Part**

Area Surrounding 9 Oakland St



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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
12A	Maybid silt loam, 0 to 3 percent slopes	1.7	4.3%
230C	Unadilla very fine sandy loam, 8 to 15 percent slopes	2.5	6.3%
255B	Windsor loamy sand, 3 to 8 percent slopes	7.9	19.9%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	2.6	6.6%
258B	Amostown fine sandy loam, 3 to 8 percent slopes	5.4	13.5%
602	Urban land	19.1	48.1%
607	Water, saline	0.5	1.3%
Totals for Area of Interest		39.8	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.

Custom Soil Resource Report

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.

Essex County, Massachusetts, Northern Part

12A—Maybid silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vjhj
Elevation: 0 to 130 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Maybid and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Maybid

Setting

Landform: Depressions, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Soft silty and clayey glaciolacustrine deposits and/or firm silty marine deposits

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 19 inches: silty clay
H3 - 19 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: C/D
Ecological site: F144AY020MA - Very Wet Coastal Lake Plain
Hydric soil rating: Yes

Minor Components

Scantic

Percent of map unit: 12 percent
Landform: Depressions

Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent

Landform: Bogs

Hydric soil rating: Yes

230C—Unadilla very fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: vjx1

Elevation: 600 to 1,800 feet

Mean annual precipitation: 45 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Unadilla and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Unadilla

Setting

Landform: Lakebeds (relict)

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Soft coarse-silty glaciolacustrine deposits

Typical profile

H1 - 0 to 9 inches: very fine sandy loam

H2 - 9 to 53 inches: very fine sandy loam

H3 - 53 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Custom Soil Resource Report

Hydrologic Soil Group: B

Ecological site: F144AY024NY - Well Drained Eolian Outwash

Hydric soil rating: No

Minor Components

Belgrade

Percent of map unit: 20 percent

Hydric soil rating: No

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf

Elevation: 0 to 1,210 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 250 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor

Setting

Landform: Outwash terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loose sandy glaciofluvial deposits derived from granite and/or schist and/or gneiss

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material

A - 1 to 3 inches: loamy sand

Bw - 3 to 25 inches: loamy sand

C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Custom Soil Resource Report

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: A

Ecological site: F145XY008MA - Dry Outwash

Hydric soil rating: No

Minor Components

Hinckley

Percent of map unit: 10 percent

Landform: Eskers

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: F145XY008MA - Dry Outwash

Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent

Landform: Terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F144AY027MA - Moist Sandy Outwash

Hydric soil rating: No

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8

Elevation: 0 to 1,100 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Deerfield

Setting

Landform: Outwash terraces, outwash deltas, outwash plains, kame terraces

Landform position (three-dimensional): Tread

Down-slope shape: Concave, convex, linear

Custom Soil Resource Report

Across-slope shape: Convex, linear, concave

Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand

Bw - 9 to 25 inches: loamy fine sand

BC - 25 to 33 inches: fine sand

Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: About 15 to 37 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Sodium adsorption ratio, maximum: 11.0

Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: A

Ecological site: F144AY027MA - Moist Sandy Outwash

Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent

Landform: Outwash terraces, kame terraces, outwash deltas, outwash plains

Landform position (three-dimensional): Tread

Down-slope shape: Concave, convex, linear

Across-slope shape: Convex, linear, concave

Hydric soil rating: No

Wareham

Percent of map unit: 5 percent

Landform: Drainageways, depressions

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Sudbury

Percent of map unit: 2 percent

Landform: Outwash plains, kame terraces, outwash deltas, outwash terraces

Landform position (three-dimensional): Tread

Down-slope shape: Concave, convex, linear

Across-slope shape: Convex, linear, concave

Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent

Landform: Kame terraces, outwash plains, outwash terraces

Custom Soil Resource Report

Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Hydric soil rating: No

258B—Amostown fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vj2g
Elevation: 0 to 100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Amostown and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amostown

Setting

Landform: Lakebeds, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable coarse-loamy glaciofluvial deposits derived from mica schist over hard coarse-loamy glaciolacustrine deposits

Typical profile

H1 - 0 to 11 inches: fine sandy loam
H2 - 11 to 38 inches: fine sandy loam
H3 - 38 to 60 inches: stratified very fine sand to silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D

Custom Soil Resource Report

Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Pollux

Percent of map unit: 20 percent
Hydric soil rating: No

Walpole variant

Percent of map unit: 10 percent
Landform: Terraces
Hydric soil rating: Yes

602—Urban land

Map Unit Setting

National map unit symbol: vjx3
Frost-free period: 125 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 2 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 2 percent
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Hydric soil rating: No

Charlton

Percent of map unit: 2 percent
Hydric soil rating: No

Paxton

Percent of map unit: 2 percent

Hydric soil rating: No

607—Water, saline

Map Unit Setting

National map unit symbol: vk29

Frost-free period: 120 to 200 days

Farmland classification: Not prime farmland

Map Unit Composition

Water, saline: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Minor Components

Westbrook

Percent of map unit: 5 percent

Landform: Marshes

Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat)

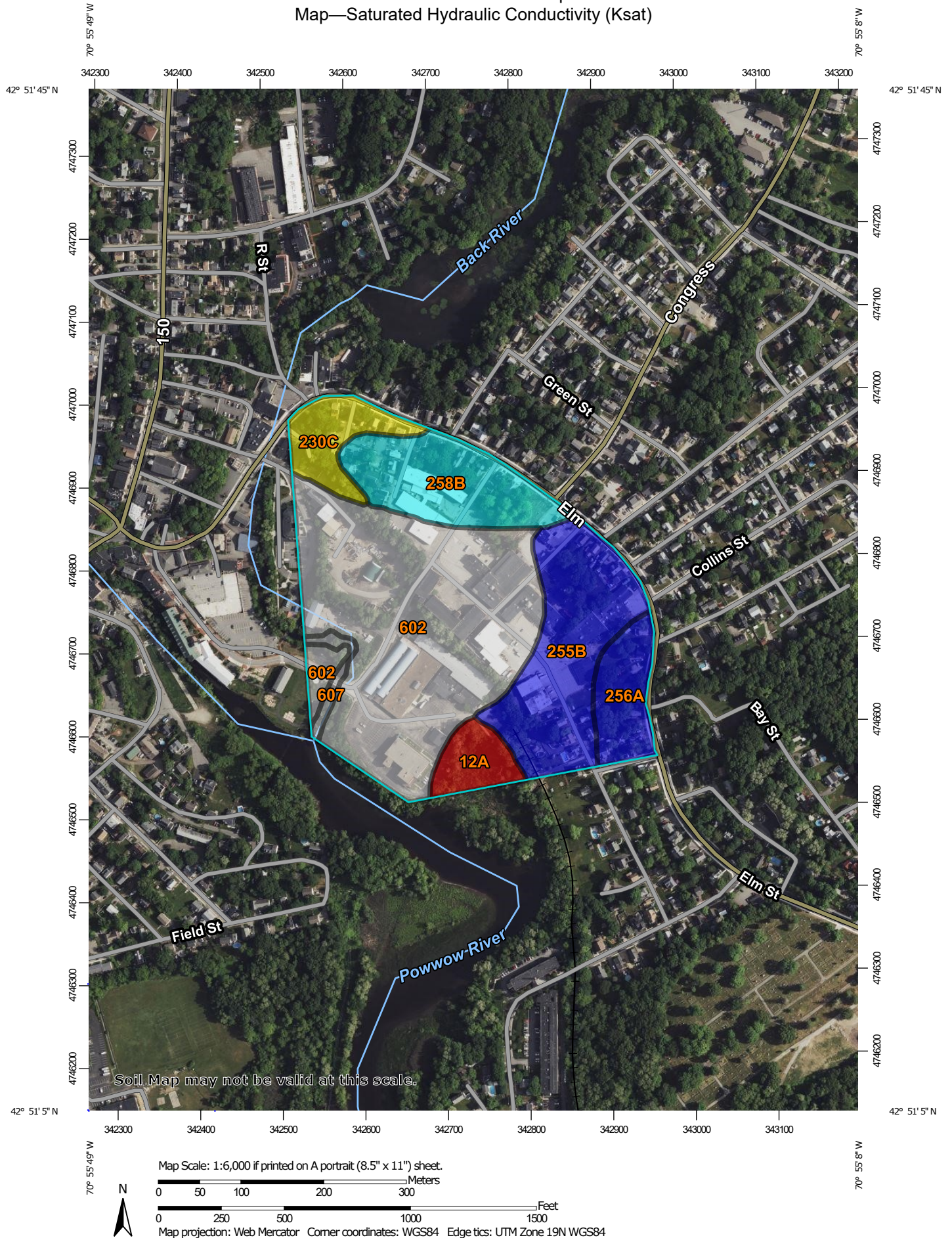
Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Custom Soil Resource Report

Map—Saturated Hydraulic Conductivity (Ksat)



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 ≤ 0.9599
 > 0.9599 and ≤ 16.8267
 > 16.8267 and ≤ 18.8583
 > 18.8583 and ≤ 100.0000
 Not rated or not available

Soil Rating Lines

 ≤ 0.9599
 > 0.9599 and ≤ 16.8267
 > 16.8267 and ≤ 18.8583
 > 18.8583 and ≤ 100.0000
 Not rated or not available

Soil Rating Points

 ≤ 0.9599
 > 0.9599 and ≤ 16.8267
 > 16.8267 and ≤ 18.8583
 > 18.8583 and ≤ 100.0000
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways

 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Essex County, Massachusetts, Northern Part
 Survey Area Data: Version 20, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Table—Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
12A	Maybid silt loam, 0 to 3 percent slopes	0.9599	1.7	4.3%
230C	Unadilla very fine sandy loam, 8 to 15 percent slopes	16.8267	2.5	6.3%
255B	Windsor loamy sand, 3 to 8 percent slopes	100.0000	7.9	19.9%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	100.0000	2.6	6.6%
258B	Amostown fine sandy loam, 3 to 8 percent slopes	18.8583	5.4	13.5%
602	Urban land		19.1	48.1%
607	Water, saline		0.5	1.3%
Totals for Area of Interest			39.8	100.0%

Rating Options—Saturated Hydraulic Conductivity (Ksat)*Units of Measure:* micrometers per second*Aggregation Method:* Dominant Condition*Component Percent Cutoff:* None Specified*Tie-break Rule:* Slowest*Interpret Nulls as Zero:* No*Layer Options (Horizon Aggregation Method):* Depth Range (Weighted Average)*Top Depth:* 0*Bottom Depth:* 600*Units of Measure:* Inches**Soil Qualities and Features**

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Unified Soil Classification (Selected Depth)

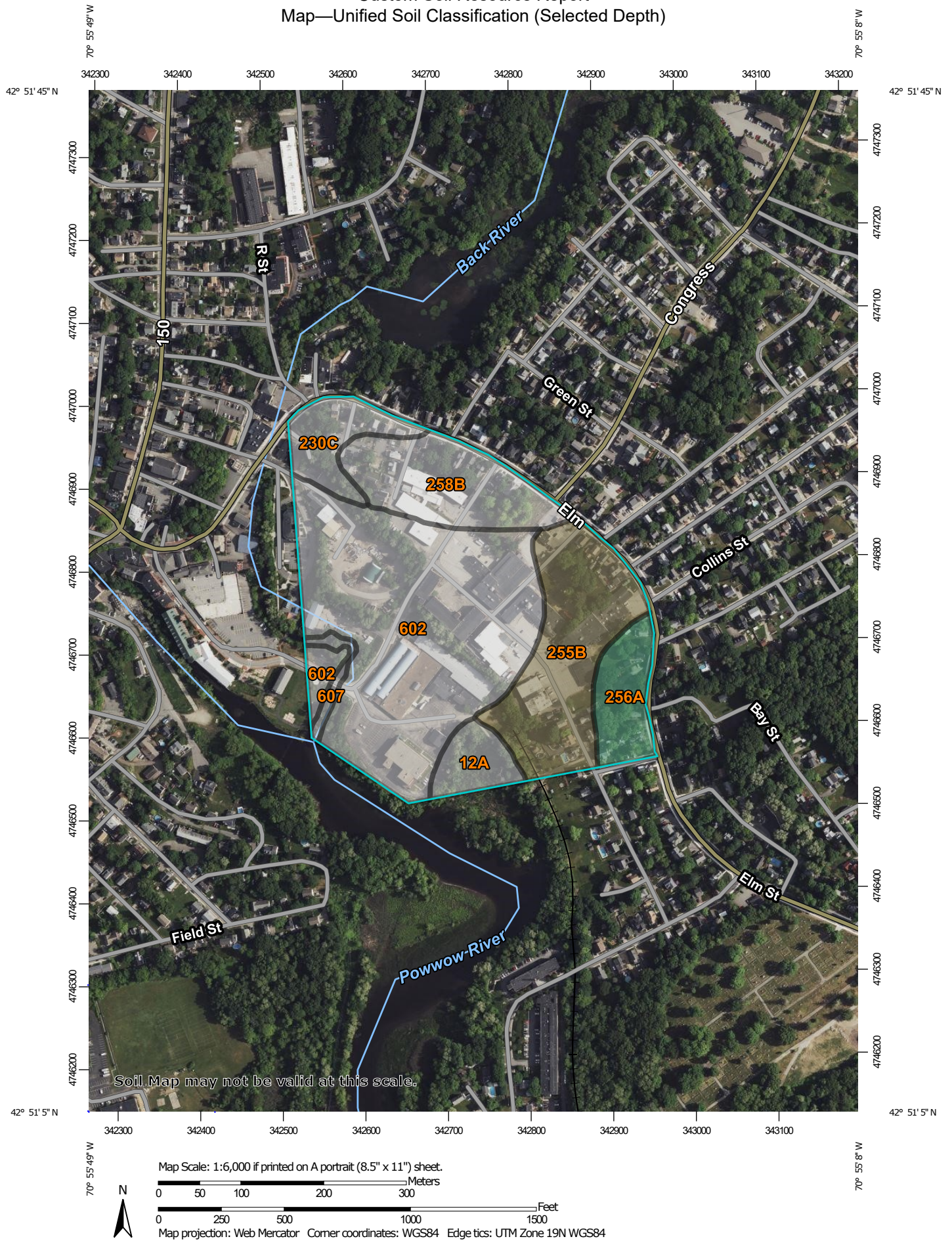
The Unified soil classification system classifies mineral and organic mineral soils for engineering purposes on the basis of particle-size characteristics, liquid limit, and plasticity index. It identifies three major soil divisions: (i) coarse-grained soils having less than 50 percent, by weight, particles smaller than 0.074 mm in diameter; (ii) fine-grained soils having 50 percent or more, by weight, particles smaller than 0.074 mm in diameter; and (iii) highly organic soils that demonstrate certain organic characteristics. These divisions are further subdivided into a total of 15 basic soil groups. The major soil divisions and basic soil groups are determined on the basis of estimated or measured values for grain-size distribution and Atterberg limits. ASTM D 2487 shows the criteria chart used for classifying soil in the Unified system and the 15 basic soil groups of the system and the plasticity chart for the Unified system.

The various groupings of this classification correlate in a general way with the engineering behavior of soils. This correlation provides a useful first step in any field or laboratory investigation for engineering purposes. It can serve to make some general interpretations relating to probable performance of the soil for engineering uses.

For each soil horizon in the database one or more Unified soil classifications may be listed. One is marked as the representative or most commonly occurring. The dominant condition or dominant component representative Unified classification is shown for the user-selected depth range of the soil.

Custom Soil Resource Report

Map—Unified Soil Classification (Selected Depth)



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

	CH		ML-A (proposed)
	CL		ML-K (proposed)
	CL-A (proposed)		ML-O (proposed)
	CL-K (proposed)		ML-T (proposed)
	CL-ML		OH
	CL-O (proposed)		OH-T (proposed)
	CL-T (proposed)		OL
	GC		PT
	GC-GM		SC
	GM		SC-SM
	GP		SM
	GP-GC		SP
	GP-GM		SP-SC
	GW		SP-SM
	GW-GC		SW
	GW-GM		SW-SC
	MH		SW-SM
	MH-A (proposed)		Not rated or not available
	MH-K (proposed)		
	MH-O (proposed)		
	MH-T (proposed)		
	ML		

Soil Rating Lines

	CH		GC
	CL		GC-GM
	CL-A (proposed)		GM
	CL-K (proposed)		GP
	CL-ML		GP-GC
	CL-O (proposed)		GP-GM
	CL-T (proposed)		GW
			GW-GC
			GW-GM
			MH
			MH-A (proposed)
			MH-K (proposed)
			MH-O (proposed)
			MH-T (proposed)
			ML
			ML-A (proposed)
			ML-K (proposed)
			ML-O (proposed)
			ML-T (proposed)
			OH
			OH-T (proposed)
			OL
			PT
			SC
			SC-SM
			SM

	SP
	SP-SC
	SP-SM
	SW
	SW-SC
	SW-SM
	Not rated or not available

Soil Rating Points

	CH		MH-K (proposed)
	CL		MH-O (proposed)
	CL-A (proposed)		MH-T (proposed)
	CL-K (proposed)		ML
	CL-ML		ML-A (proposed)
	CL-O (proposed)		ML-K (proposed)
	CL-T (proposed)		ML-O (proposed)
	GC		ML-T (proposed)
	GC-GM		OH
	GM		OH-T (proposed)
	GP		OL
	GP-GC		PT
	GP-GM		SC
	GW		SC-SM
	GW-GC		SM
	GW-GM		SP
	MH		SP-SC
	MH-A (proposed)		SP-SM

Water Features

 Streams and Canals

Transportation

 Rails

MAP INFORMATION

	Interstate Highways
	US Routes
	Major Roads
	Local Roads
Background	
	Aerial Photography

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 20, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Table—Unified Soil Classification (Selected Depth)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
12A	Maybid silt loam, 0 to 3 percent slopes		1.7	4.3%
230C	Unadilla very fine sandy loam, 8 to 15 percent slopes		2.5	6.3%
255B	Windsor loamy sand, 3 to 8 percent slopes	PT	7.9	19.9%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	SM	2.6	6.6%
258B	Amostown fine sandy loam, 3 to 8 percent slopes		5.4	13.5%
602	Urban land		19.1	48.1%
607	Water, saline		0.5	1.3%
Totals for Area of Interest			39.8	100.0%

Rating Options—Unified Soil Classification (Selected Depth)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Sum)

Top Depth: 0

Bottom Depth: 600

Units of Measure: Inches

Hydrologic Soil Group

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

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

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

Custom Soil Resource Report

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

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

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

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

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Map—Hydrologic Soil Group



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 20, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
12A	Maybid silt loam, 0 to 3 percent slopes	C/D	1.7	4.3%
230C	Unadilla very fine sandy loam, 8 to 15 percent slopes	B	2.5	6.3%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	7.9	19.9%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	2.6	6.6%
258B	Amostown fine sandy loam, 3 to 8 percent slopes	C/D	5.4	13.5%
602	Urban land		19.1	48.1%
607	Water, saline		0.5	1.3%
Totals for Area of Interest			39.8	100.0%

Rating Options—Hydrologic Soil Group*Aggregation Method:* Dominant Condition*Component Percent Cutoff:* None Specified*Tie-break Rule:* Higher

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

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United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

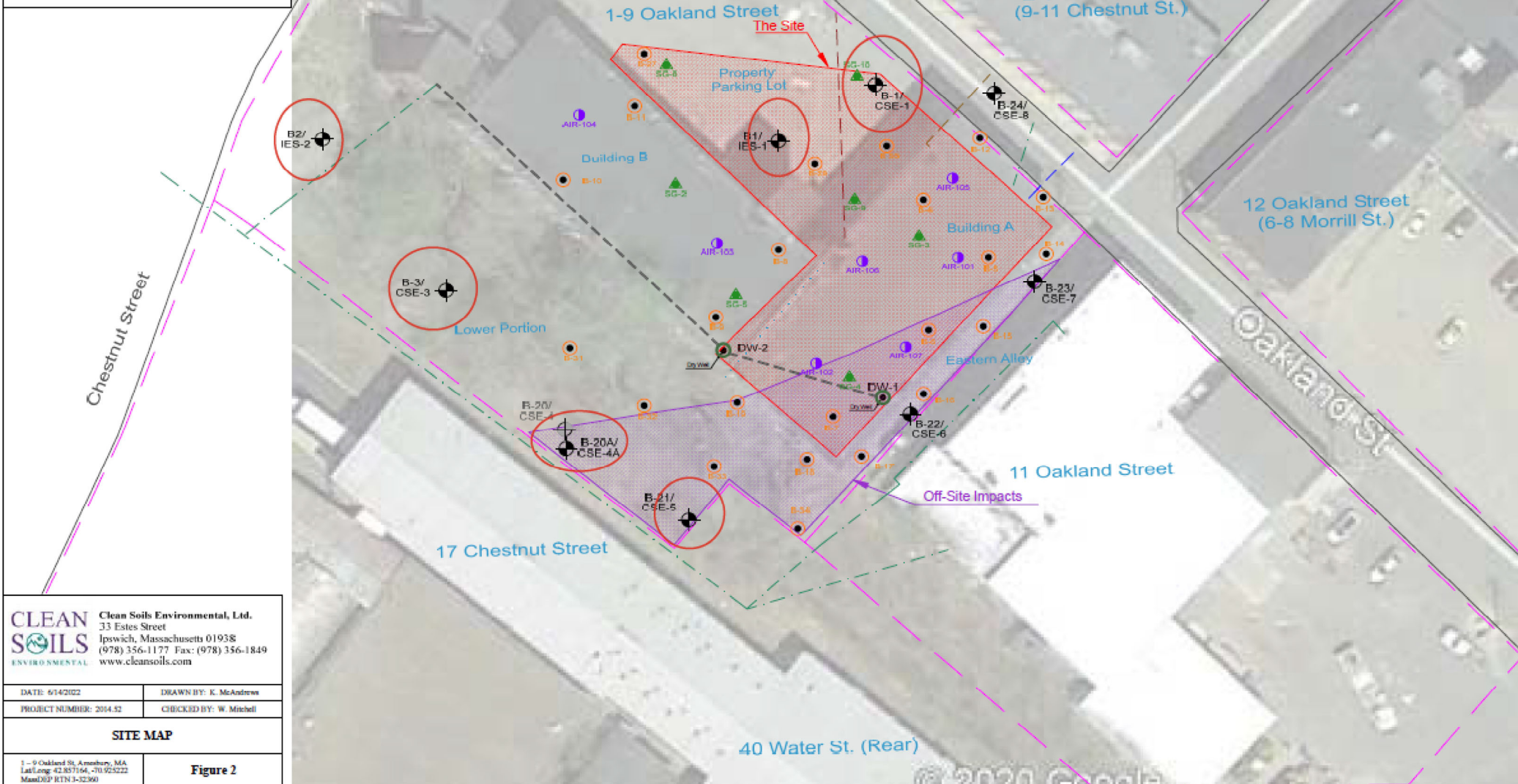
United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

ATTACHMENT 2)

**SOIL BORING LOGS AND LOCATIONS BY SOIL EXPLORATION
CORP. AND CLEAN SOILS ENVIRONMENTAL, LLC.**

LEGEND

- B-1/ CSE-1 Soil Boring/Monitoring Well
- B-10 Shallow Soil Boring
- SG-1 Soil Gas Probe
- AIR-101 Indoor Air Sample
- Gas Line
- Water Line
- Sewer Line
- Electric Line
- Parcel Boundary
- Disposal Site Boundary
- Off-Site Impacts



CLEAN SOILS
ENVIRONMENTAL

Clean Soils Environmental, Ltd.
33 Estes Street
Ipswich, Massachusetts 01938
(978) 356-1177 Fax: (978) 356-1849
www.cleansoils.com

DATE: 6/14/2022

DRAWN BY: K. McAndrews

PROJECT NUMBER: 2014.52

CHECKED BY: W. Mitchell

SITE MAP

1-9 Oakland St., Amesbury, MA
Lat/Long: 42.857104, -71.025222
MapID: RTN 3-32360

Figure 2

TEST BORING LOG

SHEET 1

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental

Site: 1 Oakland Street
Amesbury, MA

BORING B-1

PROJECT NO. 14-1246

DATE: January 5, 2015

Ground Elevation:

Date Started: December 30, 2014

Date Finished: December 30, 2014

Driller: TF

Soil Engineer/Geologist:

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
						3"	Asphalt
1		1	12"	0"-2'0"	6-5-5-4	2'0"	Medium dense fine sand, little inorganic silt, little medium to coarse sand
5		2	20"	5'0"-7'0"	4-2-2-3		
10		3	22"	10'0"-12'0"	6-8-7-8		Loose to medium dense, fine sand and inorganic silt, little medium to coarse sand.
15		4	10"	15'0"-17'0"	24-38-31-29	14'0"	
20		5	10"	20'0"-22'0"	11-14-13-15		
25		6	0"	25'0"-26'0"	52-103		Very dense to medium dense to very dense, fine to coarse sand, inorganic silt, fine to coarse gravel, cobbles.
30		7	12"	30'0"-32'0"	22-28-47-51	30'0"	
35		8	12"	35'0"-36'0"	67-93		Very dense, fine to coarse sand and some inorganic silt.
39							(Continued to Sheet 2)

Notes: Hollow Stem Auger Size - 4 1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 - 30 M Dense, 30 - 50 Dense, 50+ V Dense.	Trace	0 to 10%	CASING	SAMPLE	CORE TYPE
Cohesive: 0 - 2 V Soft, 2 - 4 Soft, 4 - 8 M Stiff	Little	10 to 20%	ID SIZE (IN)	SS	
8 - 15 Stiff, 15 - 30 V. Stiff, 30 + Hard.	Some	20 to 35%	HAMMER WGT (LB)	140 lb.	
	And	35% to 50%	HAMMER FALL (IN)	30"	

TEST BORING LOG

SHEET 2

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental
Site: 1 Oakland Street
Amesbury, MA

BORING B-1 (continued)

PROJECT NO. 14-1246

DATE: January 5, 2015

Ground Elevation:

Date Started: December 30, 2014

Date Finished: December 30, 2014

Driller: TF

Soil Engineer/Geologist:

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
40		9	12"	40'0"-42'0"	17-18-26-29	44'0"	
45							
50							
55							
60							
65							
70							
75							
79							

End of boring at 44'0".
Water encountered at 36'0".
Well set at 43'0".

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.	Trace 0 to 10% Little 10 to 20% Some 20 to 35% And 35% to 50%	CASING	SAMPLE	CORE TYPE
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.		ID SIZE (IN) HAMMER WGT (LB) HAMMER FALL (IN)	SS 140 lb. 30"	

TEST BORING LOG

SHEET 3

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental

Site: 1 Oakland Street
Amesbury, MA

BORING B-2

PROJECT NO. 14-1246

DATE: January 5, 2015

Ground Elevation:

Date Started: December 30, 2014

Date Finished: December 30, 2014

Driller: TF

Soil Engineer/Geologist:

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
No.	Pen/Rec	Depth	Blows/6"				
1	12"	0"-2'0"	6-7-4-5	3"		Asphalt	Medium dense fine to coarse sand, fine gravel, some inorganic silt.
5	16"	5'0"-7'0"	4-4-5-5	3'0"			
10	22"	10'0"-12'0"	5-6-8-9				Loose to medium dense inorganic silt, clays, fine sand, little medium to coarse sand.
15	18"	15'0"-17'0"	6-7-6-10				
20	18"	20'0"-22'0"	11-13-15-17	20'0"			
25	18"	25'0"-27'0"	25-24-36-39				
30	18"	30'0"-32'0"	19-20-26-26				Medium dense to dense to medium dense, fine sand, some inorganic silt, dry to wet.
35	18"	35'0"-37'0"	10-10-11-12				
39							(Continued to Sheet 4)

Notes: Hollow Stem Auger Size - 4 1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.	Trace	0 to 10%	CASING	SAMPLE	CORE TYPE
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.	Little	10 to 20%	ID SIZE (IN)	SS	
	Some	20 to 35%	HAMMER WGT (LB)	140 lb.	
	And	35% to 50%	HAMMER FALL (IN)	30"	

TEST BORING LOG

SHEET 4

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental
Site: 1 Oakland Street
Amesbury, MA

BORING B-2 (continued)

PROJECT NO. 14-1246

DATE: January 5, 2015

Ground Elevation:

Date Started: December 30, 2014

Date Finished: December 30, 2014

Driller: TF

Soil Engineer/Geologist:

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
40		9	18"	40'0"-42'0"	8-8-9-14	42'0"	End of boring at 42'0". Water encountered at 35'0". Well set at 40'0".
45							
50							
55							
60							
65							
70							
75							
79							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.	Trace 0 to 10% Little 10 to 20% Some 20 to 35% And 35% to 50%	ID SIZE (IN) HAMMER WGT (LB) HAMMER FALL (IN)	CASING	SAMPLE SS 140 lb. 30"	CORE TYPE
---	--	---	--------	--------------------------------	-----------

TEST BORING LOG

SHEET 5

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental

Site: 1 Oakland Street
Amesbury, MA

BORING B-3

PROJECT NO. 14-1246

DATE: January 5, 2015

Ground Elevation:

Date Started: December 31, 2014

Date Finished: December 31, 2014

Driller: TF

Soil Engineer/Geologist:

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
1		1	12"	0"-2'0"	4-5-6-10	3'0"	Medium dense fine to coarse sand, fine gravel, some inorganic silt.
5		2	16"	5'0"-7'0"	5-6-9-9		
10		3	16"	10'0"-12'0"	5-8-10-9		Medium dense fine sand, little medium sand, little inorganic silt, trace coarse sand.
15		4	18"	15'0"-17'0"	6-7-10-13	18'0"	
20		5	6"	20'0"-22'0"	18-25-22-34		Dense, fine to coarse sand, fine to coarse gravel, cobbles, some inorganic silt.
25							End of boring at 22'0". Water encountered at 13'6". Well set at 20'0".
30							
35							
39							

Notes: Hollow Stem Auger Size - 4 1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.	Trace	0 to 10%	ID SIZE (IN)	CASING	SAMPLE	CORE TYPE
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff 8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.	Little	10 to 20%			SS	
	Some	20 to 35%		HAMMER WGT (LB)	140 lb.	
	And	35% to 50%		HAMMER FALL (IN)	30"	

TEST BORING LOG

SHEET 6

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental

Site: 1 Oakland Street
Amesbury, MA

BORING GP-1

PROJECT NO. 14-1246

DATE: January 5, 2015

Ground Elevation:

Date Started: December 31, 2014

Date Finished: December 31, 2014

Driller: TF

Soil Engineer/Geologist:

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
1						9"	9" concrete core.
5						2'0"	Fine to coarse sand, fine to coarse gravel, soil gas point installed below concrete slab
10							End of boring at 2'0".
15							
20							
25							
30							
35							
39							

Notes: Gas Point 1

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 - 30 M Dense, 30 - 50 Dense, 50+ V Dense.	Trace	0 to 10%	CASING	SAMPLE	CORE TYPE
Cohesive: 0 - 2 V Soft, 2 - 4 Soft, 4 - 8 M Stiff	Little	10 to 20%	ID SIZE (IN)	SS	
8 - 15 Stiff, 15 - 30 V. Stiff, 30 + Hard.	Some	20 to 35%	HAMMER WGT (LB)	140 lb.	
	And	35% to 50%	HAMMER FALL (IN)	30"	

Project No.	2014.52	Boring No.	B-4	Monitoring Well No.	NA
Address:	1 - 9 Oakland St. Amesbury, MA	Surface Elev.	NM	Completion Depth	8 ft BGS
Lat/Long:	42.857066, -70.924782	Auger Depth	NA	Rotary Depth	NA
Installed By:	Bronson Drilling	Date Started	2/23/2015	Date Finished	2/23/2015
Engineer/Geologist:	Kevin McAndrews				
Boring Location:	Building A Interior				
Drilling Equipment:	Track Mounted Geoprobe				

Boring Location:		Building A Interior		SAMPLES					CSE Personnel		
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - concrete, fine to medium sands, light brown, dry		1	B-4 (0 - 2')	G	NA	0.5	9:45	Soil Sample "B-4" collected for VOCs		
			2								
	2 - 4 ft - fine to medium sands, light brown, dry		3	B-4 (2 - 4')	G	NA	0	9:45			
			4								
	4 - 6 ft - fine to medium sands, light brown, dry		5	B-4 (4 - 6')	G	NA	0	9:55			
			6								
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-4 (6 - 8')	G	NA	0	9:55			
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No.	2014.52	Boring No.	B-5	Monitoring Well No.	NA
Address:	1 - 9 Oakland St. Amesbury, MA	Surface Elev.	NM	Completion Depth	8 ft BGS
Lat/Long:	42.857066, -70.924782	Auger Depth	NA	Rotary Depth	NA
Installed By:	Bronson Drilling	Date Started	2/23/2015	Date Finished	2/23/2015
Engineer/Geologist:	Kevin McAndrews				
Boring Location:	Building A Interior				
Drilling Equipment:	Track Mounted Geoprobe				

Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	Remarks
	0 - 2 ft - concrete, fine to medium sands, staining, light brown, dry								
			1	B-5 (0 - 2')	G	NA	1.7	10:20	Soil Sample "B-5" collected for VOCs
			2						
	2 - 4 ft - fine to medium sands, light brown, dry		3	B-5 (2 - 4')	G	NA	0.3	10:20	
			4						
	4 - 6 ft - fine to medium sands, light brown, dry		5	B-5 (4 - 6')	G	NA	0.1	10:30	
			6						
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-5 (6 - 8')	G	NA	0	10:30	
			8						
	Boring Terminated at 8 ft BGS		9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building A Interior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-5A**
 Surface Elev. NM
 Auger Depth NA
 Date Started 6/2/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 6/2/2015

Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	Remarks
	0 - 2 ft - concrete, fine to medium sands, light brown, dry								
			1	B-5 (0 - 2')	G	NA	3.2	9:14	
			2						
	2 - 4 ft - fine to medium sands, light brown, dry		3	B-5 (2 - 4')	G	NA	0.8	9:14	
			4						
	4 - 6 ft - fine to medium sands, light brown, dry		5	B-5 (4 - 6')	G	NA	0.3	9:19	
			6						
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-5 (6 - 8')	G	NA	0.3	9:19	Soil Sample "B-5 (6 - 8)" collected for VOCs
			8						
	Boring Terminated at 8 ft BGS		9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No.	2014.52	Boring No.	B-6	Monitoring Well No.	NA
Address:	1 - 9 Oakland St. Amesbury, MA	Surface Elev.	NM	Completion Depth	8 ft BGS
Lat/Long:	42.857066, -70.924782	Auger Depth	NA	Rotary Depth	NA
Installed By:	Bronson Drilling	Date Started	2/23/2015	Date Finished	2/23/2015
Engineer/Geologist:	Kevin McAndrews				
Boring Location:	Building A Interior				
Drilling Equipment:	Track Mounted Geoprobe				

Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	Remarks
	0 - 2 ft - concrete, fine to medium sands, staining, light brown, dry								
			1	B-6 (0 - 2')	G	NA	6.2	10:50	Soil Sample "B-6" collected for VOCs
			2						
	2 - 4 ft - fine to medium sands, staining, light brown, dry		3	B-6 (2 - 4')	G	NA	5.3	10:50	
			4						
	4 - 6 ft - fine to medium sands, light brown, dry		5	B-6 (4 - 6')	G	NA	0.1	10:55	
			6						
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-6 (6 - 8')	G	NA	0.1	10:55	
			8						
	Boring Terminated at 8 ft BGS		9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No.	2014.52	Boring No.	B-7	Monitoring Well No.	NA
Address:	1 - 9 Oakland St. Amesbury, MA	Surface Elev.	NM	Completion Depth	8 ft BGS
Lat/Long:	42.857066, -70.924782	Auger Depth	NA	Rotary Depth	NA
Installed By:	Bronson Drilling	Date Started	2/23/2015	Date Finished	2/23/2015
Engineer/Geologist:	Kevin McAndrews				
Boring Location:	Building A Interior				
Drilling Equipment:	Track Mounted Geoprobe				

Boring Location:		Building A Interior		SAMPLES					CSE Personnel		
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - concrete, fine to medium sands, staining, light brown, dry		1	B-7 (0 - 2')	G	NA	2.1	11:20	Soil Sample "B-7" collected for VOCs		
			2								
	2 - 4 ft - fine to medium sands, staining, light brown, dry		3	B-7 (2 - 4')	G	NA	0.3	11:20			
			4								
	4 - 6 ft - fine to medium sands, staining, light brown, dry		5	B-7 (4 - 6')	G	NA	0.4	11:25			
			6								
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-7 (6 - 8')	G	NA	0	11:25			
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building A Interior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-7A**
 Surface Elev. NM
 Auger Depth NA
 Date Started 6/2/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 6/2/2015

Boring Location:		Building A Interior		SAMPLES					CSE Personnel		
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - concrete, fine to med sands, black staining, light brown, dry		1	B-7 (0 - 2')	G	NA	3.9	9:44			
			2								
	2 - 4 ft - fine to med sands, black staining, light brown, dry		3	B-7 (2 - 4')	G	NA	3.2	9:44			
			4								
	4 - 6 ft - fine to medium sands, light brown, dry		5	B-7 (4 - 6')	G	NA	2.3	9:48			
			6								
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-7 (6 - 8')	G	NA	0.3	9:48	Soil Sample "B-7 (6 - 8)" collected for VOCs		
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No.	2014.52	Boring No.	B-8	Monitoring Well No.	NA
Address:	1 - 9 Oakland St. Amesbury, MA	Surface Elev.	NM	Completion Depth	8 ft BGS
Lat/Long:	42.857066, -70.924782	Auger Depth	NA	Rotary Depth	NA
Installed By:	Bronson Drilling	Date Started	2/23/2015	Date Finished	2/23/2015
Engineer/Geologist:	Kevin McAndrews				
Boring Location:	Building B Interior				
Drilling Equipment:	Track Mounted Geoprobe				

Boring Location:		Building B Interior		SAMPLES						CSE Personnel	
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - concrete, fine to medium sands, light brown, dry		1	B-8 (0 - 2')	G	NA	0	12:15	Soil Sample "B-8" collected for VOCs		
			2								
	2 - 4 ft - fine to medium sands, light brown, dry		3	B-8 (2 - 4')	G	NA	0	12:15			
			4								
	4 - 6 ft - fine to medium sands, light brown, dry		5	B-8 (4 - 6')	G	NA	0	12:25			
			6								
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-8 (6 - 8')	G	NA	0	12:25			
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building B Interior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-9**
 Surface Elev. NM
 Auger Depth NA
 Date Started 2/23/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 2/23/2015

Boring Location:		Building B Interior		SAMPLES						CSE Personnel	
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - concrete, fine to medium sands, light brown, dry		1	B-9 (0 - 2')	G	NA	0	12:40	Soil Sample "B-9" collected for VOCs		
			2								
	2 - 4 ft - fine to medium sands, light brown, dry		3	B-9 (2 - 4')	G	NA	0	12:40			
			4								
	4 - 6 ft - fine to medium sands, light brown, dry		5	B-9 (4 - 6')	G	NA	0	12:50			
			6								
	6 - 8 ft - fine to medium sands, light brown, dry		7	B-9 (6 - 8')	G	NA	0	12:50			
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building B Interior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-10**
 Surface Elev. NM
 Auger Depth NA
 Date Started 2/23/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 2/23/2015

Boring Location:		Building B Interior		SAMPLES					CSE Personnel		
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - concrete, fine to medium sands, light brown, dry			B-10 (0 - 2')	G	NA	0	12:55	Soil Sample "B-10" collected for VOCs		
			1								
			2								
	2 - 4 ft - fine to medium sands, light brown, dry			B-10 (2 - 4')	G	NA	0	12:55			
			3								
			4								
	4 - 6 ft - fine to medium sands, light brown, dry			B-10 (4 - 6')	G	NA	0	13:05			
			5								
			6								
	6 - 8 ft - fine to medium sands, light brown, dry			B-10 (6 - 8')	G	NA	0	13:05			
			7								
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building B Interior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-11**
 Surface Elev. NM
 Auger Depth NA
 Date Started 2/23/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 2/23/2015

Boring Location:		Building B Interior		SAMPLES					CSE Personnel		
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - concrete, fine to medium sands, light brown, dry			B-11 (0 - 2')	G	NA	0	13:20	Soil Sample "B-11" collected for VOCs		
			1								
			2								
	2 - 4 ft - fine to medium sands, light brown, dry			B-11 (2 - 4')	G	NA	0	13:20			
			3								
			4								
	4 - 6 ft - fine to medium sands, light brown, dry			B-11 (4 - 6')	G	NA	0	13:30			
			5								
			6								
	6 - 8 ft - fine to medium sands, light brown, dry			B-11 (6 - 8')	G	NA	0	13:30			
			7								
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

**Field Boring Log**

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Project No. 2014.52
Address: 1 - 9 Oakland St. Amesbury, MA
Lat/Long: 42.857066, -70.924782
Installed By: Bronson Drilling
Engineer/Geologist: Kevin McAndrews
Boring Location: Building A Exterior
Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-12**
Surface Elev. NM
Auger Depth NA
Date Started 6/2/2015
Monitoring Well No. **NA**
Completion Depth 8 ft BGS
Rotary Depth NA
Date Finished 6/2/2015

Boring Location: Building A Exterior Drilling Equipment: Track Mounted Geoprobe					SAMPLES					CSE Personnel
						SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLE ID						
	0 - 2 ft - concrete, silty sands, light brown, dry 									

NOTES: PID = Photoionization detector used in jar-headspace screening
BGS = Below Ground Surface
▼ = Ground water encountered
ppmv = parts per million by volume
ft = feet
G = Grab
C = Composite

Soil appears to be natural formation



Project No. 2014.52
Address: 1 - 9 Oakland St. Amesbury, MA
Lat/Long: 42.857066, -70.924782
Installed By: Bronson Drilling
Engineer/Geologist: Kevin McAndrews
Boring Location: Building A Exterior
Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-13**
Surface Elev. NM
Auger Depth NA
Date Started 6/2/2015
Monitoring Well No. **NA**
Completion Depth 8 ft BGS
Rotary Depth NA
Date Finished 6/2/2015

Boring Location: Building A Exterior		Drilling Equipment: Track Mounted Geoprobe		SAMPLES						CSE Personnel		
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews			
Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet						REMARKS			
	0 - 2 ft - concrete, silty sands, light brown, dry			B-13 (0 - 2')	G	NA	0.8	12:30	Soil Sample "B-13 (0 - 2')" collected for VOCs			
			1									
			2									
			2 - 4 ft - fine sands, silts, gravels, light brown, dry			B-13 (2 - 4')	G	NA	1	12:30		
												3
												4
			4 - 6 ft - fine sands, silts, gravels, light brown, dry			B-13 (4 - 6')	G	NA	0.8	12:35		
												5
												6
			6 - 8 ft - fine sands, silts, gravels, light brown, dry			B-13 (6 - 8')	G	NA	1	12:35	Soil Sample "B-13 (6 - 8')" collected for VOCs	
	7											
	8											
	Boring Terminated at 8 ft BGS											
			9									
			10									
			11									
			12									
			13									
			14									
			15									
			16									
			17									
			18									
			19									
	20											

NOTES: PID = Photoionization detector used in jar-headspace screening
BGS = Below Ground Surface
▼ = Ground water encountered
ppmv = parts per million by volume
ft = feet
G = Grab
C = Composite

Soil appears to be natural formation

Project No.	2014.52
Address:	1 - 9 Oakland St. Amesbury, MA
Lat/Long:	42.857066, -70.924782
Installed By:	Bronson Drilling
Engineer/Geologist:	Kevin McAndrews
Boring Location:	Building A Exterior
Drilling Equipment:	Track Mounted Geoprobe

Boring No.	B-14	Monitoring Well No.	NA
Surface Elev.	NM	Completion Depth	8 ft BGS
Auger Depth	NA	Rotary Depth	NA
Date Started	6/2/2015	Date Finished	6/2/2015

Boring Location: Drilling Equipment:		Building A Exterior Track Mounted Geoprobe		SAMPLES						CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews	
Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet						Remarks	
	0 - 2 ft - asphalt, silty sands, light brown, dry		1	B-14 (0 - 2')	G	NA	1.4	12:50	Soil Sample "B-14 (0 - 2')" collected for VOCs	
			2							
	2 - 4 ft - fine sands, light brown, dry		3	B-14 (2 - 4')	G	NA	0.8	12:50		
			4							
	4 - 6 ft - fine sands, silts, gravels, light brown, dry		5	B-14 (4 - 6')	G	NA	1.1	12:55		
			6							
	6 - 8 ft - fine sands, silty clay, gravels, light brown, dry		7	B-14 (6 - 8')	G	NA	1	12:55	Soil Sample "B-14 (6 - 8')" collected for VOCs	
			8							
	Boring Terminated at 8 ft BGS		9							
			10							
			11							
			12							
			13							
			14							
			15							
			16							
			17							
			18							
			19							
			20							

NOTES: PID = Photoionization detector used in jar-headspace screening
BGS = Below Ground Surface
▼ = Ground water encountered
ppmv = parts per million by volume
ft = feet
G = Grab
C = Composite

Soil appears to be natural formation

**Field Boring Log**

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Project No. 2014.52
Address: 1 - 9 Oakland St. Amesbury, MA
Lat/Long: 42.857066, -70.924782
Installed By: Bronson Drilling
Engineer/Geologist: Kevin McAndrews
Boring Location: Building A Exterior
Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-15**
Surface Elev. NM
Auger Depth NA
Date Started 6/2/2015
Monitoring Well No. **NA**
Completion Depth 8 ft BGS
Rotary Depth NA
Date Finished 6/2/2015

Boring Location: Building A Exterior				SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet						Remarks
					0 - 2 ft - asphalt, silty sands, light brown, dry		1	B-15 (0 - 2')	G
			2						
			3						
	2 - 4 ft - fine sands, light brown, dry		4	B-15 (2 - 4')	G	NA	1.7	13:00	
			5						
			6						
	4 - 6 ft - fine sands, silts, gravels, light brown to orange, dry		7	B-15 (4 - 6')	G	NA	1	13:05	
			8						
			9						
	6 - 8 ft - fine sands, silty clay, light brown, dry		10	B-15 (6 - 8')	G	NA	0.7	13:05	Soil Sample "B-15 (6 - 8')" collected for VOCs
			11						
			12						
	Boring Terminated at 8 ft BGS		13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

NOTES: PID = Photoionization detector used in jar-headspace screening
BGS = Below Ground Surface
▼ = Ground water encountered
ppmv = parts per million by volume
ft = feet
G = Grab
C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building A Exterior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-16**
 Surface Elev. NM
 Auger Depth NA
 Date Started 6/2/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 6/2/2015

Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	Remarks
	0 - 2 ft - asphalt, silty sands, dark brown, staining, dry		1	B-16 (0 - 2')	G	NA	1.6	13:10	Soil Sample "B-16 (0 - 2')" collected for VOCs
			2						
	2 - 4 ft - fine sands, med brown, staining, dry		3	B-16 (2 - 4')	G	NA	4.9	13:10	Soil Sample "B-16 (2 - 4')" collected for VOCs
			4						
	4 - 6 ft - fine to med sands, minor silt, light brown, dry		5	B-16 (4 - 6')	G	NA	2.4	13:15	
			6						
	6 - 8 ft - fine sands, silty clay, light brown, dry		7	B-16 (6 - 8')	G	NA	2.6	13:15	Soil Sample "B-16 (6 - 8')" collected for VOCs
			8						
	Boring Terminated at 8 ft BGS		9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building A Exterior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-17**
 Surface Elev. NM
 Auger Depth NA
 Date Started 6/2/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 6/2/2015

Boring Location:		Building A Exterior		SAMPLES						CSE Personnel	
Drilling Equipment:		Track Mounted Geoprobe		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - asphalt, med to fine sands, dark brown, dry		1	B-17 (0 - 2')	G	NA	0.5	13:20	Soil Sample "B-17 (0 - 2')" collected for VOCs		
			2								
	2 - 4 ft - silt w/ brick frags, dark brown, dry		3	B-17 (2 - 4')	G	NA	1.4	13:20			
			4								
	4 - 6 ft - fine to med sands, med brown, dry		5	B-17 (4 - 6')	G	NA	0.4	13:25			
			6								
	6 - 8 ft - fine sands, silty clay, light brown, dry		7	B-17 (6 - 8')	G	NA	0.2	13:25	Soil Sample "B-17 (6 - 8')" collected for VOCs		
			8								
	Boring Terminated at 8 ft BGS		9								
			10								
			11								
			12								
			13								
			14								
			15								
			16								
			17								
			18								
			19								
			20								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation



Project No. 2014.52
Address: 1 - 9 Oakland St. Amesbury, MA
Lat/Long: 42.857066, -70.924782
Installed By: Bronson Drilling
Engineer/Geologist: Kevin McAndrews
Boring Location: Building A Exterior
Drilling Equipment: Hammer Drill

Boring No. **B-18**
Surface Elev. NM
Auger Depth NA
Date Started 6/2/2015
Monitoring Well No. **NA**
Completion Depth 8 ft BGS
Rotary Depth NA
Date Finished 6/2/2015

Boring Location:		Building A Exterior		SAMPLES					CSE Personnel		
Drilling Equipment:		Hammer Drill		Graphic Log	Depth in Feet	SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
Elev	DESCRIPTION OF MATERIALS	Remarks									
	0 - 2 ft - organic loam, dark brown, dry			B-18 (0 - 2')	G	NA	0.5	10:45	Soil Sample "B-18 (0 - 2')" collected for VOCs		
			1								
			2	B-18 (2 - 4')	G	NA	0.6	10:50			
			3								
			4								
			5	B-18 (4 - 6')	G	NA	0.4	10:55			
			6								
			4 - 6 ft - fine to med sands, light brown, dry	7	B-18 (6 - 8')	G	NA	0.6	11:00	Soil Sample "B-18 (6 - 8')" collected for VOCs	
	8										
	9	Boring Terminated at 8 ft BGS									
	10										
	11										
	12										
	13										
	14										
	15										
	16										
	17										
	18										
	19										
	20										

NOTES: PID = Photoionization detector used in jar-headspace screening
BGS = Below Ground Surface
▼ = Ground water encountered
ppmv = parts per million by volume
ft = feet
G = Grab
C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building A Exterior
 Drilling Equipment: Hammer Drill

Boring No. **B-19**
 Surface Elev. NM
 Auger Depth NA
 Date Started 6/2/2015
 Monitoring Well No. **NA**
 Completion Depth 8 ft BGS
 Rotary Depth NA
 Date Finished 6/2/2015

Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	G - Kevin McAndrews
	0 - 2 ft - organic loam, dark brown, dry		1	B-19 (0 - 2')	G	NA	1	11:20	Soil Sample "B-19 (0 - 2')" collected for VOCs
	2 - 4 ft - fine to med sands, light brown, dry		3	B-19 (2 - 4')	G	NA	0.9	11:25	
	4 - 6 ft - fine to med sands, light brown, dry		5	B-19 (4 - 6')	G	NA	1	11:30	
	6 - 8 ft - fine to med sands, light brown, dry		7	B-19 (6 - 8')	G	NA	0.2	11:35	Soil Sample "B-19 (6 - 8')" collected for VOCs
	Boring Terminated at 8 ft BGS		8						
			9						
			10						
			11						
			12						
			13						
			14						
			15						
			16						
			17						
			18						
			19						
			20						

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building A Exterior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-20**
 Surface Elev. NM
 Auger Depth NA
 Date Started 6/2/2015
 Monitoring Well No. **CSE-4**
 Completion Depth 20 ft BGS
 Rotary Depth NA
 Date Finished 6/2/2015

Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	Remarks
	0 - 4 ft - fine to coarse sand, minor silt, staining, dark brown, dry	▼	1	B-20 (0 - 4')	G	NA	0.3	14:30	
			2						
			3						
			4						
	4 - 8 ft - fine to medium sand, minor silt, staining, med brown, dry		5	B-20 (4 - 8')	G	NA	1	14:35	
			6						
			7						
			8						
	8 - 12 ft - fine to medium sand, light brown, moist		9	B-20 (8 - 12')	G	NA	0.4	14:40	
			10						
			11						
			12						
	12 - 16 ft - fine to medium sand, med brown, wet		13	B-20 (12 - 16')	G	NA	0.5	14:45	
			14						
			15						
			16						
	16 - 20 ft - fine to medium sand, light to med brown, wet		17	B-20 (16 - 20')	G	NA	1.7	14:50	Soil Sample "B-20 (16 - 20)" collected for VOCs
			18						
			19						
			20						
	Boring Terminated at 20 ft BGS								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 ▼ = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

Project No. 2014.52
 Address: 1 - 9 Oakland St. Amesbury, MA
 Lat/Long: 42.857066, -70.924782
 Installed By: Bronson Drilling
 Engineer/Geologist: Kevin McAndrews
 Boring Location: Building A Exterior
 Drilling Equipment: Track Mounted Geoprobe

Boring No. **B-21**
 Surface Elev. NM
 Auger Depth NA
 Date Started 6/2/2015
 Monitoring Well No. **CSE-5**
 Completion Depth 20 ft BGS
 Rotary Depth NA
 Date Finished 6/2/2015

Elev	DESCRIPTION OF MATERIALS	Graphic Log	Depth in Feet	SAMPLES					CSE Personnel
				SAMPLE ID	SAMPLE TYPE (G or C)	BLOW COUNTS	PID READINGS (ppmv)	TIME COLLECTED	Remarks
	0 - 4 ft - fine to coarse sand, minor silt, staining, dark brown, dry		1	B-21 (0 - 4')	G	NA	1.2	15:30	
			2						
			3						
			4						
	4 - 8 ft - fine to medium sand, minor silt, staining, dark brown, dry		5	B-21 (4 - 8')	G	NA	15.8	15:35	
			6						
			7						
			8						
	8 - 12 ft - fine to medium sand, light brown, moist		9	B-21 (8 - 12')	G	NA	2.4	15:40	
			10						
			11						
			12						
	12 - 16 ft - fine to medium sand, med brown, wet		13	B-21 (12 - 16')	G	NA	1.8	15:45	Soil Sample "B-21 (12 - 16)" collected for VOCs
			14						
			15						
			16						
	16 - 20 ft - fine to medium sand, light to med brown, wet		17	B-21 (16 - 20')	G	NA	1.4	15:50	
			18						
			19						
			20						
	Boring Terminated at 20 ft BGS								

NOTES: PID = Photoionization detector used in jar-headspace screening
 BGS = Below Ground Surface
 = Ground water encountered
 ppmv = parts per million by volume
 ft = feet
 G = Grab
 C = Composite

Soil appears to be natural formation

TEST BORING LOG

SHEET 1

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental

Site: 1 Oakland Street
Amesbury, MA

BORING B-22

PROJECT NO. 15-0622

DATE: June 10, 2015

Ground Elevation:

Date Started: June 10, 2015

Date Finished: June 10, 2015

Driller: G

Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
						3"	Asphalt
1		1	13"	1'0"-3'0"	5-5-6-5	3'0"	Loose to medium dense fine sand, little inorganic silt, little medium to coarse sand, brick frags
5		2	18"	5'0"-7'0"	1-2-6-8		Loose dense, fine sand and inorganic silt, fine to coarse gravel, cobbles
10		3	24"	10'0"-12'0"	12-15-24-21	9'0"	
15		4	18"	15'0"-17'0"	13-18-20-23		
20		5	16"	20'0"-22'0"	14-22-25-26		Medium dense to very dense, fine to coarse sand, inorganic silt, fine to coarse gravel, cobbles.
25		6	8"	25'0"-27'0"	19-24-27-30		
30		7	16"	30'0"-32'0"	21-25-28-32	30'0"	
35		8	2"	35'0"-37'0"	100/2"		Very dense, fine to coarse sand, inorganic silt, fine to coarse gravel, dry to wet.
39							

Notes: Hollow Stem Auger Size - 4 1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 - 30 M Dense, 30 - 50 Dense, 50+ V Dense.	Trace	0 to 10%	CASING	SAMPLE	CORE TYPE
Cohesive: 0 - 2 V Soft, 2 - 4 Soft, 4 - 8 M Stiff	Little	10 to 20%	ID SIZE (IN)	SS	
8 - 15 Stiff, 15 - 30 V. Stiff, 30 + Hard	Some	20 to 35%	HAMMER WGT (LB)	140 lb.	
	And	35% to 50%	HAMMER FALL (IN)	30"	

TEST BORING LOG

SHEET 2

Soil Exploration Corp.

Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental
Site: 1 Oakland Street
Amesbury, MA

BORING B-22 (continued)

PROJECT NO. 15-0622

DATE: June 10, 2015

Ground Elevation:

Date Started: June 10, 2015

Date Finished: June 10, 2015

Driller: G

Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
40		9	0"	40'0"-42'0"	21-24-36-41	44'0"	End of boring at 44'0". Water encountered at 36'0". Well set at 43'0".
45							
50							
55							
60							
65							
70							
75							
79							

Notes: Hollow Stem Auger Size - 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.	Trace Little Some And	0 to 10% 10 to 20% 20 to 35% 35% to 50%	ID SIZE (IN) HAMMER WGT (LB) HAMMER FALL (IN)	CASING	SAMPLE SS 140 lb. 30"	CORE TYPE
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TEST BORING LOG

SHEET 3

Soil Exploration Corp.
Geotechnical Drilling
Groundwater Monitor Well
148 Pioneer Drive
Leominster, MA 01453
978 840-0391

Clean Soils Environmental
Site: 1 Oakland Street
Amesbury, MA

BORING B-23

PROJECT NO. 15-0622

DATE: June 10, 2015

Ground Elevation:

Date Started: June 10, 2015

Date Finished: June 10, 2015

Driller: G

Soil Engineer/Geologist: KM

GROUNDWATER OBSERVATIONS

DATE	DEPTH	CASING	STABILIZATION

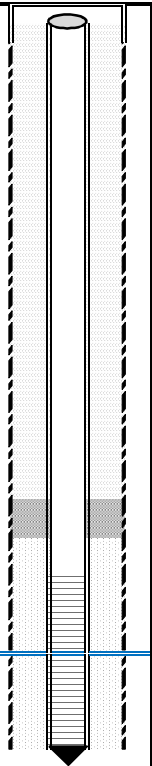
Depth Ft.	Casing bl/ft	Sample				Strata	Visual Identification of Soil and / or Rock Sample
		No.	Pen/Rec	Depth	Blows/6"		
						3"	Asphalt
1		1	12"	1'0"-3'0"	4-5-5-6	3'0"	Medium dense fine sand, little inorganic silt, little medium to coarse sand
5		2	17"	5'0"-7'0"	8-14-20-22		Medium dense, fine sand and inorganic silt, fine to coarse gravel, cobbles
10		3	16"	10'0"-12'0"	11-20-22-27	9'0"	
15		4	15"	15'0"-17'0"	24-24-27-28		Medium dense to very dense, fine to coarse sand, inorganic silt, fine to coarse gravel, cobbles.
20		5	17"	20'0"-22'0"	23-21-22-22	20'0"	
25		6	9"	25'0"-27'0"	47-75/4"		
30		7	0"	30'0"-32'0"	75/4"		Very dense, fine to coarse sand, inorganic silt, dry to wet.
35		8	0"	35'0"-37'0"	100/3"		
							End of boring at 36'0". Water encountered at 34'0". Well set at 35'0".

Notes: Hollow Stem Auger Size - 4 1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose, 10 -30 M Dense, 30 -50 Dense, 50+ V Dense.	Trace	0 to 10%	CASING	SAMPLE	CORE TYPE
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M Stiff	Little	10 to 20%	ID SIZE (IN)	SS	
8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard	Some	20 to 35%	HAMMER WGT (LB)	140 lb.	
	And	35% to 50%	HAMMER FALL (IN)	30"	

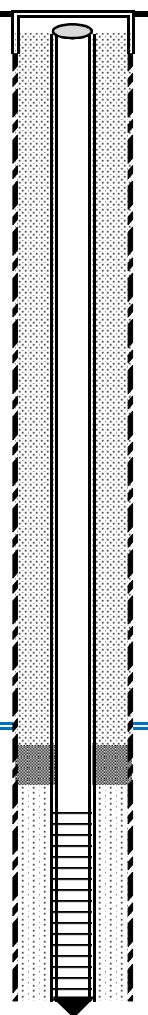
SOIL BORING LOG

ADDRESS:					1 - 9 Oakland St. Amesbury, MA					BORING/WELL ID:		B-24 / CSE-8	
INSTALLED BY:					Technical Drilling Services					DATE:		7/6/2017	
ENGINEER/GEOLOGIST:					Kevin McAndrews					PROJECT #:		2014.52	
BORING LOCATION:					Oakland Street Roadway					TOTAL DEPTH: 40'		WELL DIAMETER: 2"	
DRILLING METHOD:					Hollow Stem Auger					WATER TABLE: 34'		CONSTRUCTION: PVC	

DEPTH (ft.)	SAMPLE ID	BLOWS PER 6"	PID (ppm)	LAB	DESCRIPTION	DEPTH BGS (ft)	DIAGRAM	WELL CONSTRUCTION
0 - 5'					No Recovery, Utility Clearance	0		
5 - 7'	A	3,4,6,6	0.1		SM: fine sands w/ silt, olive gray to light brown, dry	2		
						4		
						6		
						8		
						10		
10 - 12'	B	8,10,19,25	0.1		SM: fine sands w/ silty interbeds, tan to light brown, dry	12		
						14		
						16		
15 - 17'	C	5,12,13,15	0		SM-GM: fine to crs sand, silty gravels, light to med brown, dry	18		
						20		
20 - 22'	D	10,15,16,22	0.1			22		
						24		
25 - 27'	E	23,39,44,120	0.2		SM-SC: silty sand with clay interbeds, trace gravel, light to med brown, dry	26		
						28		
						30		
30 - 32'	F	20,42,55,120	0			32		
						34		
35 - 37'	G	44,40,120	0.2	X	SM-SC: silty sand with clay interbeds, trace gravel, light to med brown, wet	36		
						38		
						40		
					Boring Terminated at 40'	42		
						44		
						46		
						48		
						50		

REMARKS: Soils consist mainly of native glacial tills and glaciofluvial deposits
Bedrock refusal not encountered
No significant contamination observed

ADDRESS: 1 - 9 Oakland St. Amesbury, MA					BORING/WELL ID: B-25 / CSE-9		
INSTALLED BY: Technical Drilling Services					DATE: 8/28/2017		
ENGINEER/GEOLOGIST: Kevin McAndrews					PROJECT #: 2014.52		
BORING LOCATION: Oakland Street Roadway					TOTAL DEPTH: 50'		WELL DIAMETER: 2"
DRILLING METHOD: Hollow Stem Auger					WATER TABLE: 36'		CONSTRUCTION: PVC

DEPTH (ft.)	SAMPLE ID	BLOWS PER 6"	PID (ppm)	LAB	DESCRIPTION	DEPTH BGS (ft)	DIAGRAM	WELL CONSTRUCTION
						0		
0 - 5'					No Recovery, Utility Clearance	2		
						4		
5 - 7'	A	2,3,4,5	0.1		ML: silty, fine sands, trace clay, light to olive gray, dry	6		
						8		
						10		
10 - 12'	B	2,4,5,6	0.1			12		
						14		
						16		
15 - 17'	C	2,4,5,7	0		ML: silty, fine sands, trace clay, light brown, dry	18		
						20		
20 - 22'	D	3,6,7,10	0			22		
						24		
25 - 27'	E	9,23,10,13	0		SM: fine to med sands, light brown, dry	26		
						28		
						30		
30 - 32'	F	22,26,30,34	0		GW: fine to med sand, gravels, light to med brown, dry	32		
						34		
35 - 37'	G	20,17,22,27	0		SM: fine sand, silt, med brown, moist	36		
						38		
						40		
40 - 42'	H	10,10,14,16	1.5	X	ML: silty, fine sands, trace clay, olive gray, moist	42		
						44		
45 - 47'	I	9,13,22,17	0.3			46		
						48		
						50		
					Boring Terminated at 50'			

REMARKS: Soils consist mainly of native glacial tills and glaciofluvial deposits

Bedrock refusal not encountered

No significant contamination observed

Roadbox:

YES

Native Fill/Grout:

0 - 37'

Bentonite Seal:

37 - 39'

PVC Riser:

0 - 40'

Sand Pack:

39 - 50'

Screen:

40 - 50'

Well Cap:

@ 50'

Obv. Contam?

N

SOIL SUITABILITY ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS

AMESBURY, MASSACHUSETTS

SOIL EVALUATION FOR NEW CONSTRUCTION OF ON-SITE STORMWATER CONTROL

SITE INFORMATION

March 05, 2026

Street Address: 9 Oakland Street Town: Amesbury State: Massachusetts Zip Code: 01913 County: Essex

Land Use: Industrial Latitude: ~42° 51' 25.80" N Longitude: ~70° 55' 30.93" W

PUBLISHED SOIL DATA AND MAP UNIT DESCRIPTION

Physiographic Division: Appalachian Highlands Province: New England Section: Seaboard lowland section

NRCS/USDA web soil survey: Essex County, Massachusetts, Northern Part Soil Series name: 602 – Urban Land

Order: _____ Suborder: _____ Family: _____

Drainage Class: _____ Ksat: _____

Hydric soil rating: _____ Depth to water table: _____ Depth to restrictive feature: _____

Frequency of flooding: _____ Frequency of ponding: _____ Available water supply, 00" to 60": _____

Hydrologic Soil Group: _____ Runoff class: _____ Ecological site: _____

WETLAND AREA & USGS WELL MEASUREMENTS

National Wetland Inventory Map: NA Wetlands Conservancy Program: NA Bordering vegetative wetland: >200 feet

Current Water Resource Condition (USGS): Well Site # 424841071004101-MA-HLW 23 Haverhill, MA.

Well depth: 15.10 feet Land surface altitude: 100.00 feet above NGVD29 Latitude: ~42°48'41.8"N Longitude: ~71°00'41.7"

Most recent data value: 14.17' on 03/05/26 (depth to water level in feet below land surface)

SURFICIAL GEOLOGY:

Surficial Geology: _____

Geologic parent material: Excavated and filled land Landform: _____

Slope aspect: _____ Landform position (2D): _____ Landform position (3D): _____

Slope gradient: _____ Down slope shape: _____ Across slope shape: _____

Bedrock outcropping in vicinity: _____ Glacial erratics in vicinity: _____

Bedrock Type: Newburyport Complex; Gray, medium-grained porphyritic granite with microcline, Silurian in age.

TP26-1 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

Date: March 05, 2026

Weather: Overcast, light breeze, 35-45°F, dry.

Land Use: Commercial

Vegetation: Paved driveway

Landscape: Upland

Landform: Summit

Position on landscape: Toeslope/ Rise

Slope aspect: Easterly

Slope (%): 03- 08%

Slope complexity: Simple

Property line: 10⁺ feet

Drainage way: 50⁺ feet

Drinking water well: 50⁺ feet

Abutting septic system: 50⁺ feet

Wetlands: 50⁺ feet

Public water supply reservoir: 400⁺ feet

Tributary to reservoir: 200⁺ feet

Unsuitable materials present: Shallow to bedrock: Fill material: X Fractured rock:

SOIL PROFILE ► TP26-1

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Matrix Color (Munsell)	Redoxomorphic Features: Depth, color, percentage	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, coarse fragments % by volume, stratification, artifacts, restrictive features, etc.
00" → 31"	^ FILL	Sandy Loam Loamy Sand Fill mixture	10YR 2/1 black	none observed	Mechanically mixed anthropic layer; human transported material; structureless-massive; fine-to-medium grained mineral content; various soil textures mixed within fill matrix; non-sticky; damp; non-plastic; unstable; abrupt wavy boundary.
31" → 39"	B _w	Fine Sandy Loam	10YR 5/4 yellowish brown	none observed	Friable; weak-grade, fine to medium, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; damp matrix; non-sticky; non-plastic; free of clasts; few fine-to-medium roots; abrupt wavy boundary.
39" → 107"	2C	Very Fine Sandy Loam	2.5Y 5/4 light olive brown	none observed	Friable to firm; moderately compact matrix; tight in-situ; massive to subangular platy structure of moderate grade; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; well graded; free of clasts; no redoxomorphic features observed; roots to a depth of 44"; no apparent water observed; no bedrock refusal at test hole depth.

Depth to bedrock: > 107"

Seasonal High Groundwater Table:

Apparent water table:

TP26-1 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

NONE OBSERVED

Depth of Estimated Seasonal High Groundwater Table: _____ (below land surface)

Kind: _____

Shape: _____ Location: _____

Hardness: _____ Boundary: _____ Abundance: _____ Size: _____ Contrast: _____

Concentration color: _____ Reduction color: _____ Moisture state: Damp

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE

NONE OBSERVED

Apparent water seeping from pit face: _____ (below land surface) Depth to stabilized apparent water: _____ (below land surface)

Soil moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: _____ inches below grade

Observed water weeping from side of deep hole: _____ inches below grade

Observed depth to stabilized phreatic water: _____ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 6.33'

Depth of naturally occurring pervious material in TP26-1

Upper boundary: 31"

Lower boundary: 107"

Certification

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

#1848

F. Alexander Parker

Massachusetts Soil Evaluator and license number

October 1998

Date of License issuance

Unofficial testing for drainage

Amesbury Town Witness

03/05/26

Date of soil testing

TP26-2 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

Date: March 05, 2026 Weather: Overcast, light breeze, 35-45°F, dry.
 Land Use: Commercial Vegetation: Paved driveway
 Landscape: Upland Landform: Summit Position on landscape: Toeslope/ Rise
 Slope aspect: Easterly Slope (%): 01- 08% Slope complexity: Simple
 Property line: 10⁺ feet Drainage way: 50⁺ feet Drinking water well: 50⁺ feet Abutting septic system: 50⁺ feet
 Wetlands: 50⁺ feet Public water supply reservoir: 400⁺ feet Tributary to reservoir: 200⁺ feet
 Unsuitable materials present: Shallow to bedrock: Fill material: X Fractured rock:

SOIL PROFILE ► TP26-2

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Matrix Color (Munsell)	Redoxomorphic Features: Depth, color, percentage	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, coarse fragments % by volume, stratification, artifacts, restrictive features, etc.
00" → 30"	^ FILL	Sandy Loam Loamy Sand Fill mixture	10YR 2/1 black	none observed	Mechanically mixed anthropic layer; human transported material; structureless-massive; fine-to-medium grained mineral content; various soil textures mixed within fill matrix; non-sticky; damp; non-plastic; unstable; abrupt wavy boundary.
30" → 39"	B _w	Fine Sandy Loam	10YR 5/4 yellowish brown	none observed	Friable; weak-grade, fine to medium, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; damp matrix; non-sticky; non-plastic; free of clasts; few fine-to-medium roots; abrupt wavy boundary.
39" → 108"	2C	Very Fine Sandy Loam	2.5Y 5/4 light olive brown	none observed	Friable to firm; moderately compact matrix; tight in-situ; massive to subangular platy structure of moderate grade; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; well graded; free of clasts; no redoximorphic features observed; roots to a depth of 44"; no apparent water observed; no bedrock refusal at test hole depth.

Depth to bedrock: > 108" Seasonal High Groundwater Table: Apparent water table:

TP26-2 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

NONE OBSERVED

Depth of Estimated Seasonal High Groundwater Table: _____ (below land surface)

Kind: _____

Shape: _____ Location: _____

Hardness: _____ Boundary: _____ Abundance: _____ Size: _____ Contrast: _____

Concentration color: _____ Reduction color: _____ Moisture state: Damp

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE

NONE OBSERVED

Apparent water seeping from pit face: _____ (below land surface) Depth to stabilized apparent water: _____ (below land surface)

Soil moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: _____ inches below grade

Observed water weeping from side of deep hole: _____ inches below grade

Observed depth to stabilized phreatic water: _____ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 6.50'

Depth of naturally occurring pervious material in TP26-2

Upper boundary: 30"

Lower boundary: 108"

Certification

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

#1848

F. Alexander Parker

Massachusetts Soil Evaluator and license number

October 1998

Date of License issuance

Unofficial testing for drainage

Amesbury Town Witness

03/05/26

Date of soil testing

TP26-3 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

Date: March 05, 2026

Weather: Overcast, light breeze, 35-45°F, dry.

Land Use: Commercial

Vegetation: Lightly wooded

Landscape: Upland

Landform: Flat

Position on landscape: Toeslope/ Rise

Slope aspect: Easterly

Slope (%): 01- 08%

Slope complexity: Simple

Property line: 10⁺ feet

Drainage way: 50⁺ feet

Drinking water well: 50⁺ feet

Abutting septic system: 50⁺ feet

Wetlands: 50⁺ feet

Public water supply reservoir: 400⁺ feet

Tributary to reservoir: 200⁺ feet

Unsuitable materials present: Shallow to bedrock: ____ Fill material: X Fractured rock: ____

SOIL PROFILE ► TP26-3

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Matrix Color (Munsell)	Redoxomorphic Features: Depth, color, percentage	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, coarse fragments % by volume, stratification, artifacts, restrictive features, etc.
00" → 35"	^ FILL	Sandy Loam Loamy Sand Fill mixture	10YR 2/1 black	none observed	Mechanically mixed anthropic layer; human transported material; structureless-massive; fine-to-medium grained mineral content; various soil textures mixed within fill matrix; non-sticky; damp; non-plastic; unstable; abrupt wavy boundary.
35" → 38"	B _w	Fine Loamy Sand	10YR 5/4 yellowish brown	none observed	Friable; weak-grade, fine to medium, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; damp matrix; non-sticky; non-plastic; free of clasts; few fine-to-medium roots; abrupt wavy boundary.
38" → 108"	2C	Fine to Medium Sand	2.5Y 5/4 light olive brown	none observed	Friable; moderately compact matrix; massive structure of moderate grade; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; well graded; free of clasts; no redoximorphic features observed; roots to a depth of 39"; no apparent water observed; no bedrock refusal at test hole depth.

Depth to bedrock: ≥ 108"

Seasonal High Groundwater Table: ____

Apparent water table: ____

TP26-3 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

NONE OBSERVED

Depth of Estimated Seasonal High Groundwater Table: _____ (below land surface)

Kind: _____

Shape: _____ Location: _____

Hardness: _____ Boundary: _____ Abundance: _____ Size: _____ Contrast: _____

Concentration color: _____ Reduction color: _____ Moisture state: Damp

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE

NONE OBSERVED

Apparent water seeping from pit face: _____ (below land surface) Depth to stabilized apparent water: _____ (below land surface)

Soil moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: _____ inches below grade

Observed water weeping from side of deep hole: _____ inches below grade

Observed depth to stabilized phreatic water: _____ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 6.08'

Depth of naturally occurring pervious material in TP26-3

Upper boundary: 35"

Lower boundary: 108"

Certification

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

#1848

F. Alexander Parker

Massachusetts Soil Evaluator and license number

October 1998

Date of License issuance

Unofficial testing for drainage

Amesbury Town Witness

03/05/26

Date of soil testing

TP26-4 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

Date: March 05, 2026

Weather: Overcast, light breeze, 35-45°F, dry.

Land Use: Commercial

Vegetation: Lightly wooded

Landscape: Upland

Landform: Flat

Position on landscape: Toeslope/ Rise

Slope aspect: Easterly

Slope (%): 01- 08%

Slope complexity: Simple

Property line: 10⁺ feet

Drainage way: 50⁺ feet

Drinking water well: 50⁺ feet

Abutting septic system: 50⁺ feet

Wetlands: 50⁺ feet

Public water supply reservoir: 400⁺ feet

Tributary to reservoir: 200⁺ feet

Unsuitable materials present: Shallow to bedrock: Fill material: X Fractured rock:

SOIL PROFILE ► TP26-4

Depth below land surface (inches)	Soil Horizon/ Layer	Soil Texture (USDA/ NRCS)	Soil Matrix Color (Munsell)	Redoxomorphic Features: Depth, color, percentage	Consistence, grade, size, structure, grain size, soil moisture state, roots, horizon boundary, coarse fragments % by volume, stratification, artifacts, restrictive features, etc.
00" → 32"	^ FILL	Sandy Loam Loamy Sand Fill mixture	10YR 2/1 black	none observed	Mechanically mixed anthropic layer; human transported material; structureless-massive; fine-to-medium grained mineral content; various soil textures mixed within fill matrix; non-sticky; damp; non-plastic; unstable; abrupt wavy boundary.
32" → 39"	B _w	Fine Loamy Sand	10YR 5/4 yellowish brown	none observed	Friable; weak-grade, fine to medium, sub-angular blocky structure; somewhat cohesive; mixed medium to mostly fine-grained mineral content; damp matrix; non-sticky; non-plastic; free of clasts; few fine-to-medium roots; abrupt wavy boundary.
39" → 110"	2C	Fine to Medium Sand	2.5Y 5/4 light olive brown	none observed	Friable; moderately compact matrix; massive structure of moderate grade; mixed fine-to-medium grained mineral content; crudely stratified; damp matrix; non-sticky; non-plastic; well graded; free of clasts; no redoximorphic features observed; roots to a depth of 41"; no apparent water observed; no bedrock refusal at test hole depth.

Depth to bedrock: > 110"

Seasonal High Groundwater Table:

Apparent water table:

TP26-4 DEEP OBSERVATION HOLE

9 Oakland Street, Amesbury, Massachusetts

ESTIMATED SEASONAL HIGH GROUNDWATER TABLE

NONE OBSERVED

Depth of Estimated Seasonal High Groundwater Table: _____ (below land surface)

Kind: _____

Shape: _____ Location: _____

Hardness: _____ Boundary: _____ Abundance: _____ Size: _____ Contrast: _____

Concentration color: _____ Reduction color: _____ Moisture state: Damp

DEPTH TO APPARENT/ PHREATIC GROUNDWATER TABLE

NONE OBSERVED

Apparent water seeping from pit face: _____ (below land surface) Depth to stabilized apparent water: _____ (below land surface)

Soil moisture state: Damp

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Observed depth to redoximorphic features: _____ inches below grade

Observed water weeping from side of deep hole: _____ inches below grade

Observed depth to stabilized phreatic water: _____ inches below grade

DEPTH OF NATURALLY OCCURRING PERVIOUS MATERIAL ► 6.50'

Depth of naturally occurring pervious material in TP26-4

Upper boundary: 32"

Lower boundary: 110"

Certification

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

#1848

F. Alexander Parker

Massachusetts Soil Evaluator and license number

October 1998

Date of License issuance

Unofficial testing for drainage

Amesbury Town Witness

03/05/26

Date of soil testing

SOIL SUITABILITY INFILTRATION TEST

DOUBLE RING INFILTROMETER

AMESBURY, MASSACHUSETTS

9 Oakland Street Amesbury, Massachusetts

<u>Double Ring Infiltrometer</u>	<u>Infiltration Test TP26-1</u>	<u>Infiltration Test TP26-2</u>
Depth of test:	48"	48"
Start Time (3")	0 minutes	0 minutes
Time at 0"	18:40minutes	20:15 minutes
Average rate of infiltration (seconds per inch)	6.22 minutes per inch 9.6 inches per hour	6.75 minutes per inch 8.9inches per hour

SOIL SUITABILITY INFILTRATION TEST

DOUBLE RING INFILTROMETER

AMESBURY, MASSACHUSETTS

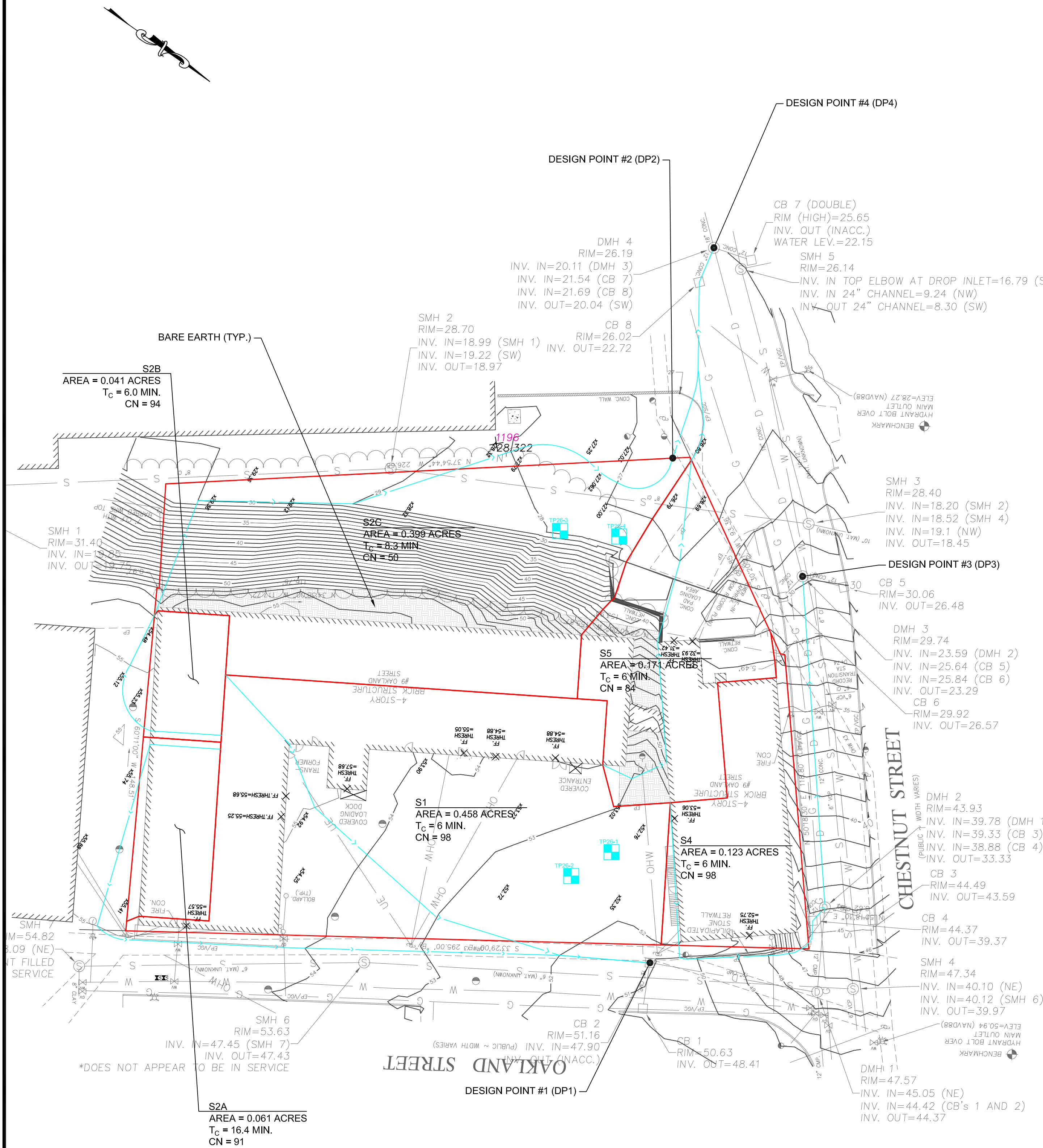
9 Oakland Street, Amesbury, Massachusetts

<u>Double Ring Infiltrometer</u>	<u>Infiltration Test-TP26-3</u>	<u>Infiltration Test-TP26-4</u>
Depth of test:	60"	60"
Start Time (3")	0 minutes	0 minutes
Time at 0"	3:20 minutes	3:30 minutes
Average rate of infiltration (seconds per inch)	1.11 minutes per inch 54 inches per hour	1.17 minutes per inch 51 inches per hour

ATTACHMENT 3)

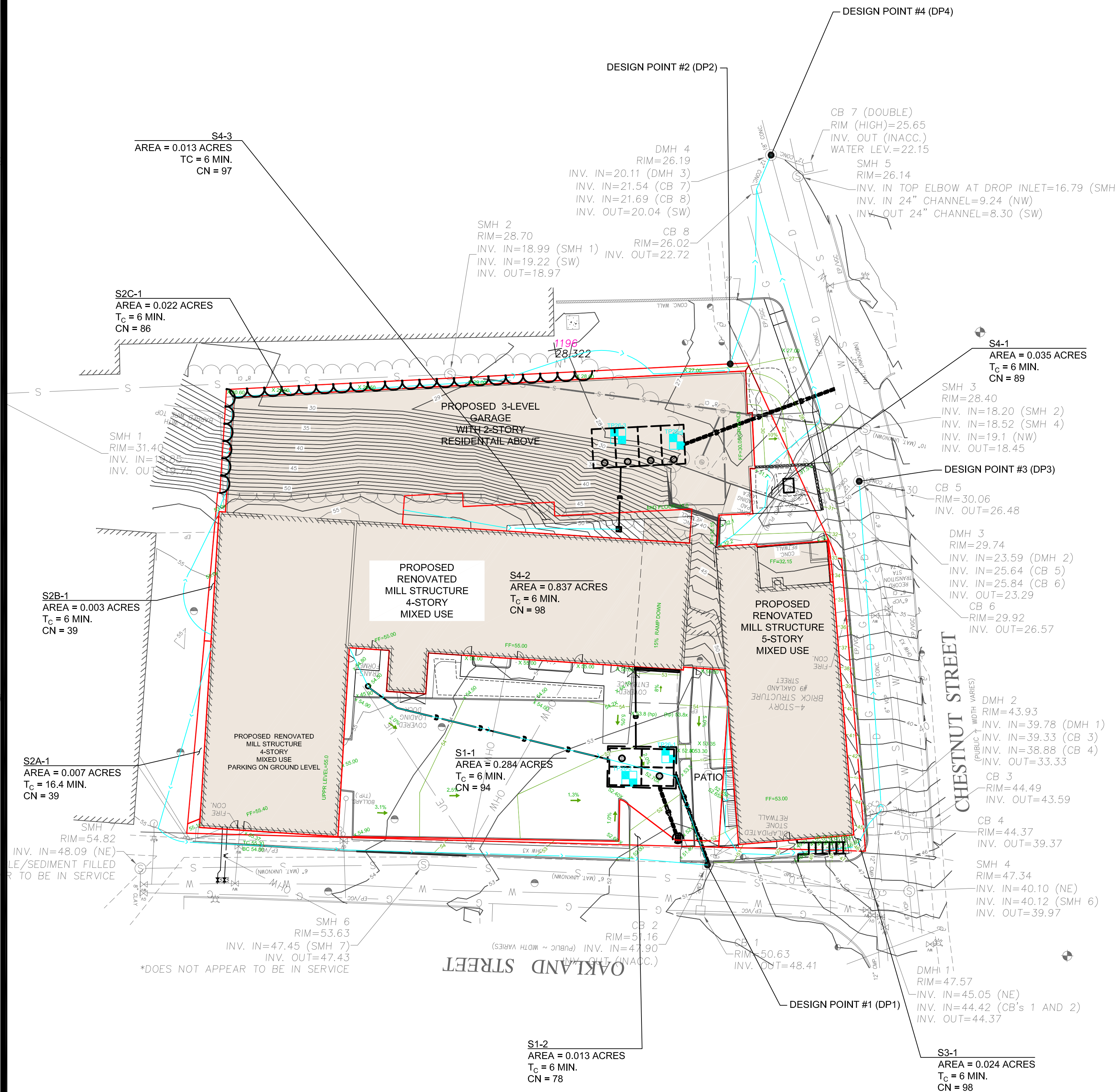
PRE- & POST DEVELOPMENT DRAINAGE AREAS

E:\adskproj-2025\M254459\DWG\M254459-D rev3-Citemns.dwg



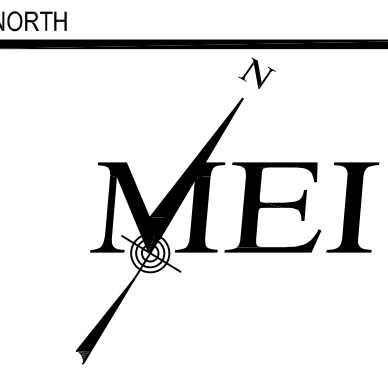
PRE-DEVELOPMENT

1" = 30'



POST-DEVELOPMENT

1" = 30'



MILLENNIUM ENGINEERING, INC.
ENGINEERING AND LAND SURVEYING
62 ELM ST. SALISBURY, MA 01952
(978) 463-8980

OWNER:

9 OAKLAND STREET
AMESBURY LLC
PO BOX 999
DANVILLE NH 03819

PROJECT TEAM

9 OAKLAND ST
CARRIAGE HILL LOFTS
4-STORY BUILDING WITH
GARAGE
9 OAKLAND STREET
AMESBURY, MA

PROJECT INFO

REV	DESCRIPTION	DATE
1.0	PER REVIEWER COMMENT	3/16/2026



STAMP:

PRE-, POST-,
DRAINAGE
PLAN

SHEET NAME:

1 OF 1

SHT NO:

DR BY: SBS

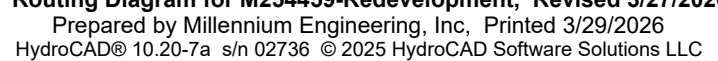
CHK BY: AM

PROJ NO: M254459

DATE: SEPT. 23, 2025

SCALE: AS NOTED

ATTACHMENT 4)
HYDROCAD HYDROLOGY PRINTOUT



M254459-Redevelopment

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.110	39	>75% Grass cover, Good, HSG A (S1-1, S1-2, S2A, S2A-1, S2B, S2B-1, S2C, S2C-1, S3, S4, S4-1)
0.075	77	Fallow, bare soil, HSG A (S2C, S4)
0.068	96	Gravel surface, HSG A (S1-1, S2C-1, S3-1, S4-1, S4-3)
0.653	98	Paved parking, HSG A (S1, S1-1, S1-2, S2C, S3, S3-1, S4, S4-1)
1.168	98	Roofs, HSG A (S1, S3, S4, S4-2)
0.211	98	Unconnected roofs, HSG A (S2A, S2B, S2C, S4-3)
0.234	30	Woods, Good, HSG A (S2C, S4)
2.518	88	TOTAL AREA

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Summary for Subcatchment S1: Parking & Front of Buildings

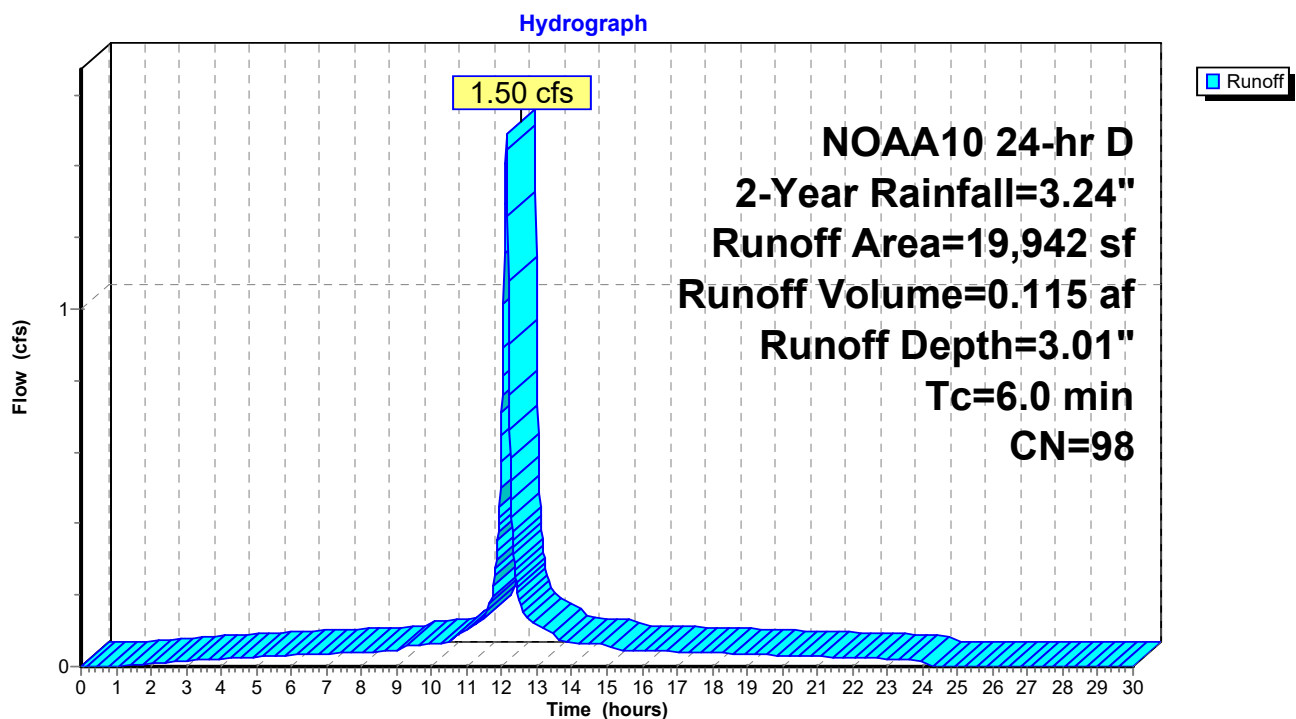
Runoff = 1.50 cfs @ 12.13 hrs, Volume= 0.115 af, Depth= 3.01"
Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
12,479	98	Paved parking, HSG A
7,463	98	Roofs, HSG A
19,942	98	Weighted Average
19,942		100.00% Impervious Area

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

Subcatchment S1: Parking & Front of Buildings



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Summary for Subcatchment S1-1: Drains to Parking Lot Chambers

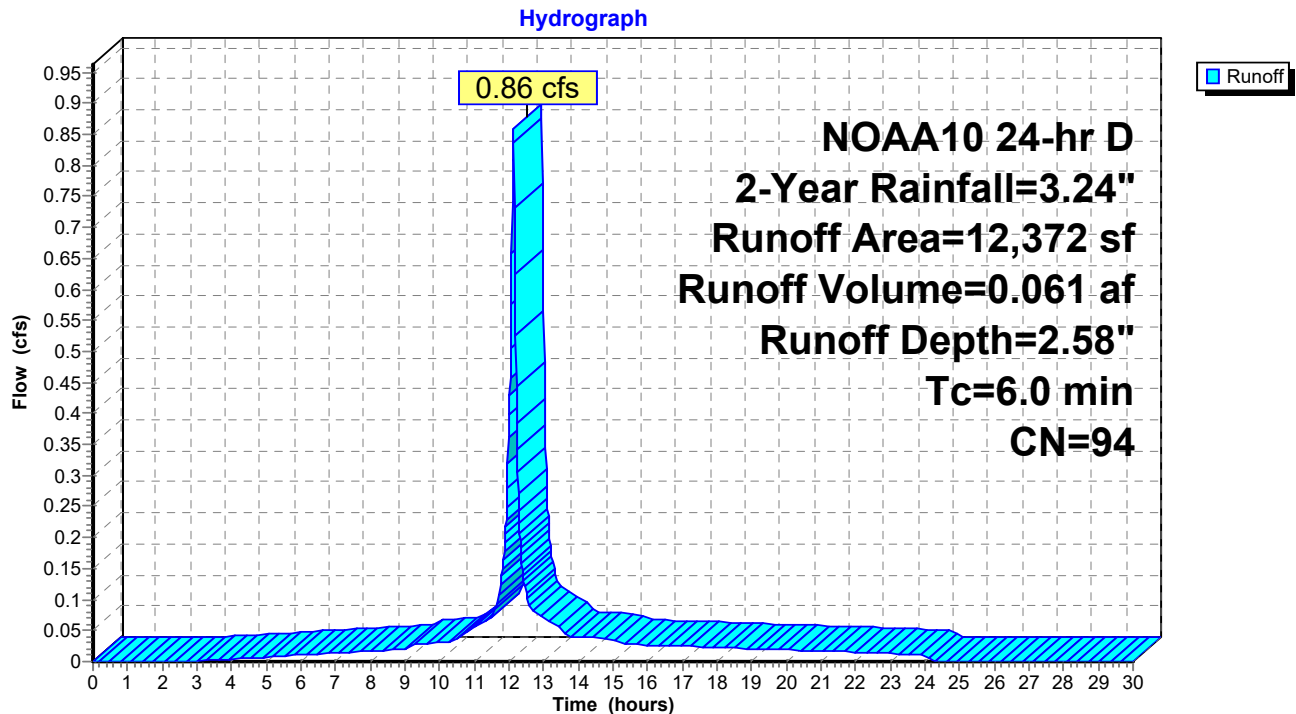
Runoff = 0.86 cfs @ 12.13 hrs, Volume= 0.061 af, Depth= 2.58"

Routed to Pond CDS1 : Water Quality Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
717	39	>75% Grass cover, Good, HSG A
1,237	96	Gravel surface, HSG A
10,418	98	Paved parking, HSG A
12,372	94	Weighted Average
1,954		15.79% Pervious Area
10,418		84.21% Impervious Area

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

Subcatchment S1-1: Drains to Parking Lot Chambers

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Summary for Subcatchment S1-2: Untreated Runoff onto Oakland St.

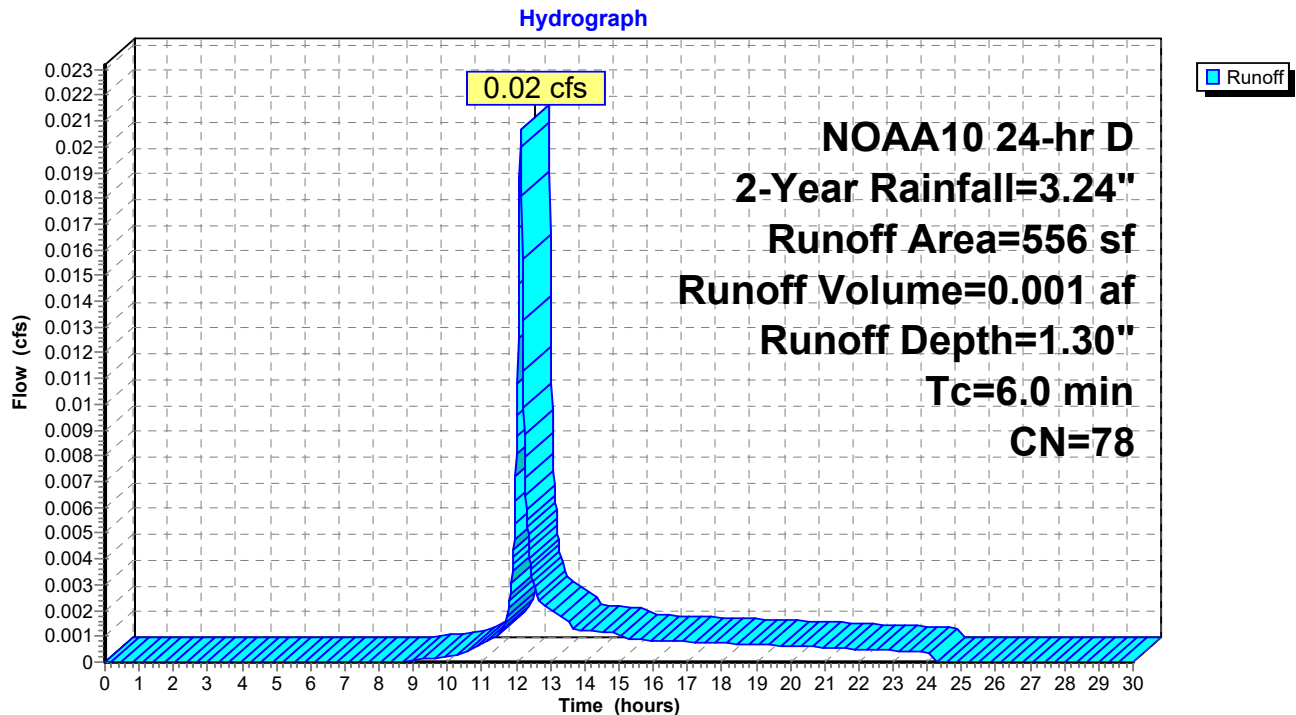
Runoff = 0.02 cfs @ 12.13 hrs, Volume= 0.001 af, Depth= 1.30"

Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
191	39	>75% Grass cover, Good, HSG A
365	98	Paved parking, HSG A
556	78	Weighted Average
191		34.35% Pervious Area
365		65.65% Impervious Area

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

Subcatchment S1-2: Untreated Runoff onto Oakland St.

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S2A: Easterly Roof & Lot Line

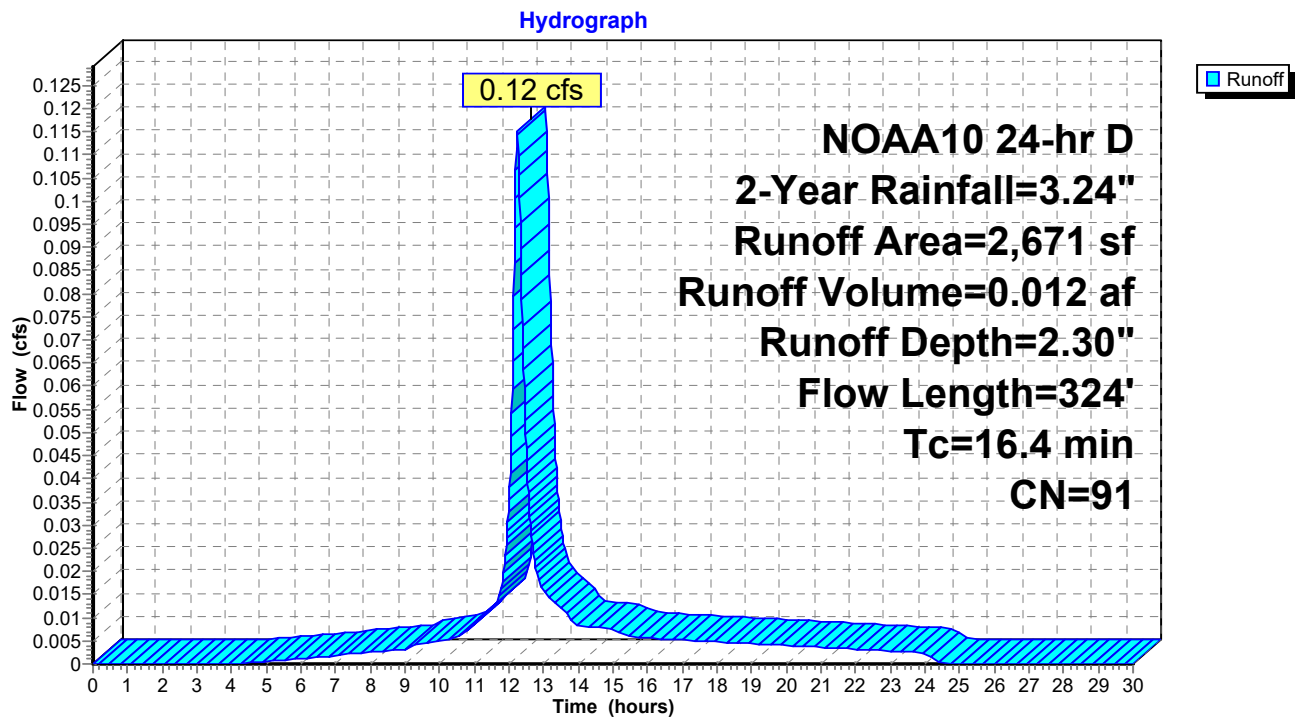
Runoff = 0.12 cfs @ 12.24 hrs, Volume= 0.012 af, Depth= 2.30"

Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
322	39	>75% Grass cover, Good, HSG A
2,349	98	Unconnected roofs, HSG A
2,671	91	Weighted Average
322		12.06% Pervious Area
2,349		87.94% Impervious Area
2,349		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A: Easterly Roof & Lot Line

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S2A-1: Easterly Lot Line

Runoff = 0.00 cfs @ 24.03 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

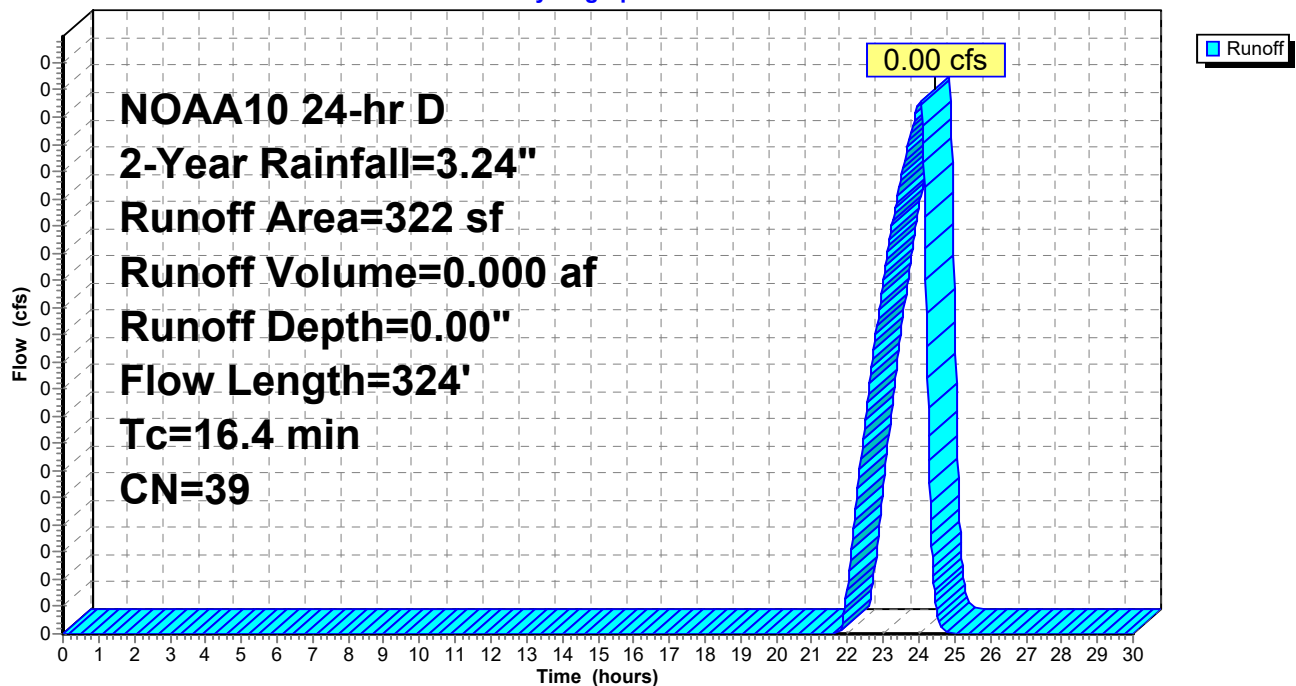
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
322	39	>75% Grass cover, Good, HSG A
322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A-1: Easterly Lot Line

Hydrograph



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Summary for Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

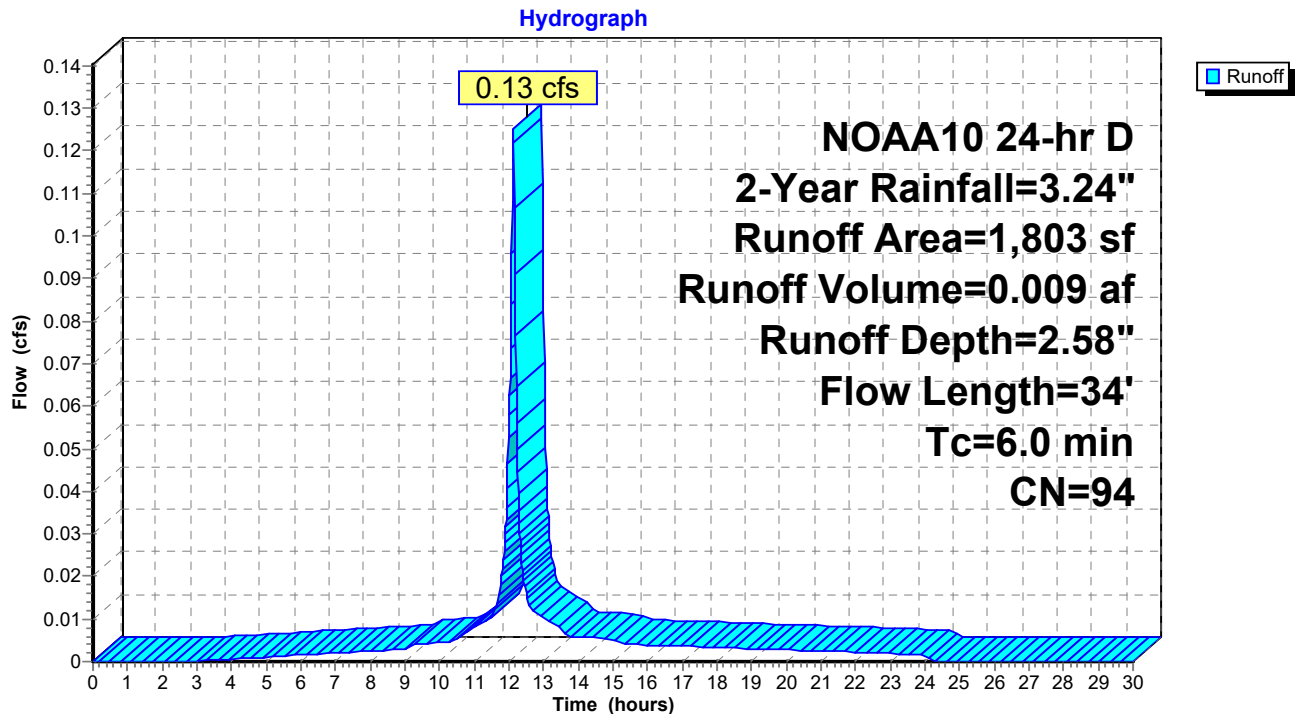
Runoff = 0.13 cfs @ 12.13 hrs, Volume= 0.009 af, Depth= 2.58"

Routed to Link L2 : Lag Time for Flow from S2B to DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
1,685	98	Unconnected roofs, HSG A
1,803	94	Weighted Average
118		6.54% Pervious Area
1,685		93.46% Impervious Area
1,685		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	34		0.09		Direct Entry, Assumed Minimum

Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214

Runoff = 0.00 cfs @ 24.02 hrs, Volume= 0.000 af, Depth= 0.00"

Routed to Link L2-1 : Lag Time for Flow from S2B-1 to DP2-1

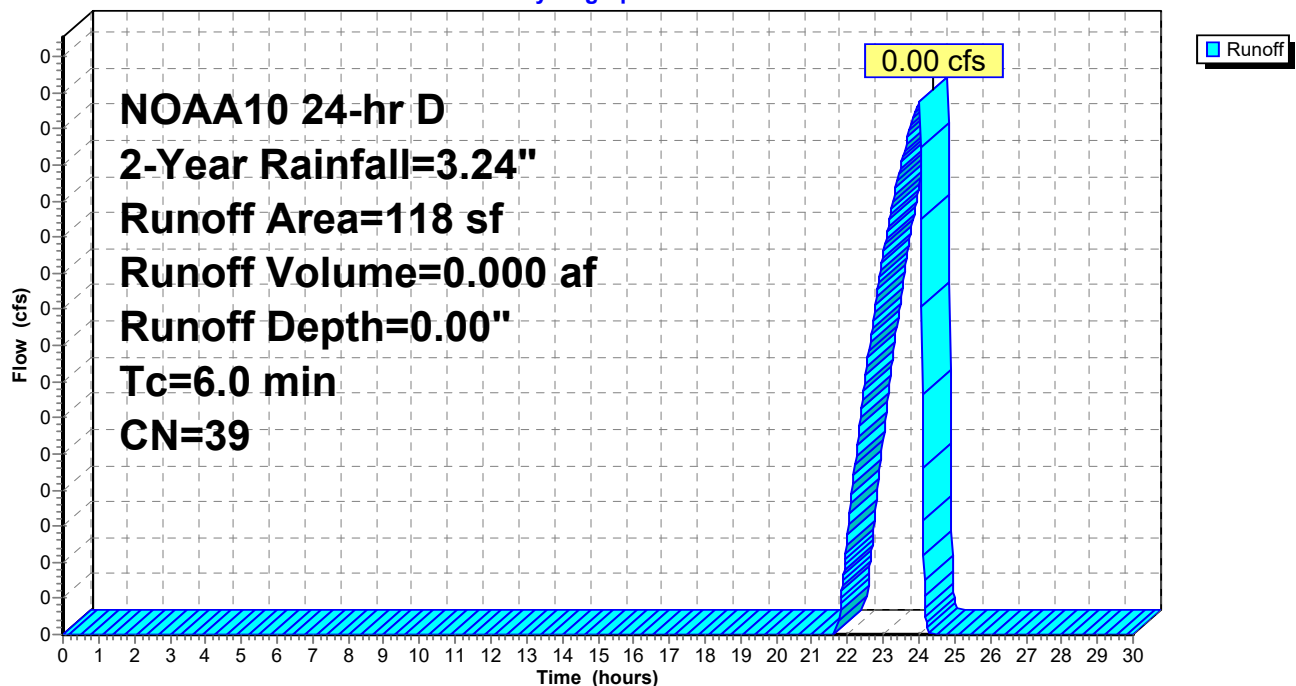
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
118		100.00% Pervious Area

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

Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214

Hydrograph



M254459-Redevelopment

NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S2C: Rear of Building & Site (SW)

Runoff = 0.00 cfs @ 19.64 hrs, Volume= 0.002 af, Depth= 0.06"

Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

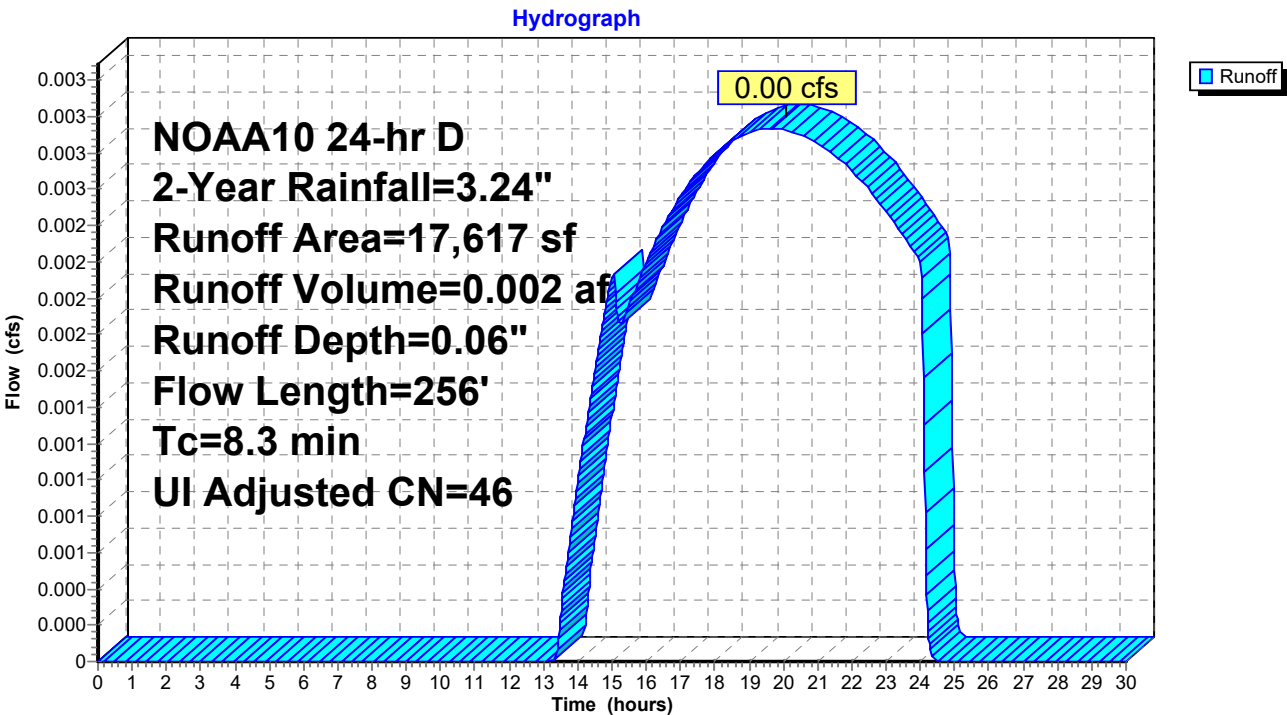
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Adj	Description
1,157	39		>75% Grass cover, Good, HSG A
80	98		Paved parking, HSG A
4,226	98		Unconnected roofs, HSG A
2,147	77		Fallow, bare soil, HSG A
10,007	30		Woods, Good, HSG A
17,617	53	46	Weighted Average, UI Adjusted
13,311			75.56% Pervious Area
4,306			24.44% Impervious Area
4,226			98.14% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	53	0.4720	0.24		Sheet Flow, Wooded Slope Woods: Light underbrush n= 0.400 P2= 3.24"
4.5	177	0.0169	0.65		Shallow Concentrated Flow, Wooded Swale Woodland Kv= 5.0 fps
0.2	26	0.0169	1.95		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
8.3	256	Total			

Subcatchment S2C: Rear of Building & Site (SW)



M254459-Redevelopment

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S2C-1: Perimeter of Garage

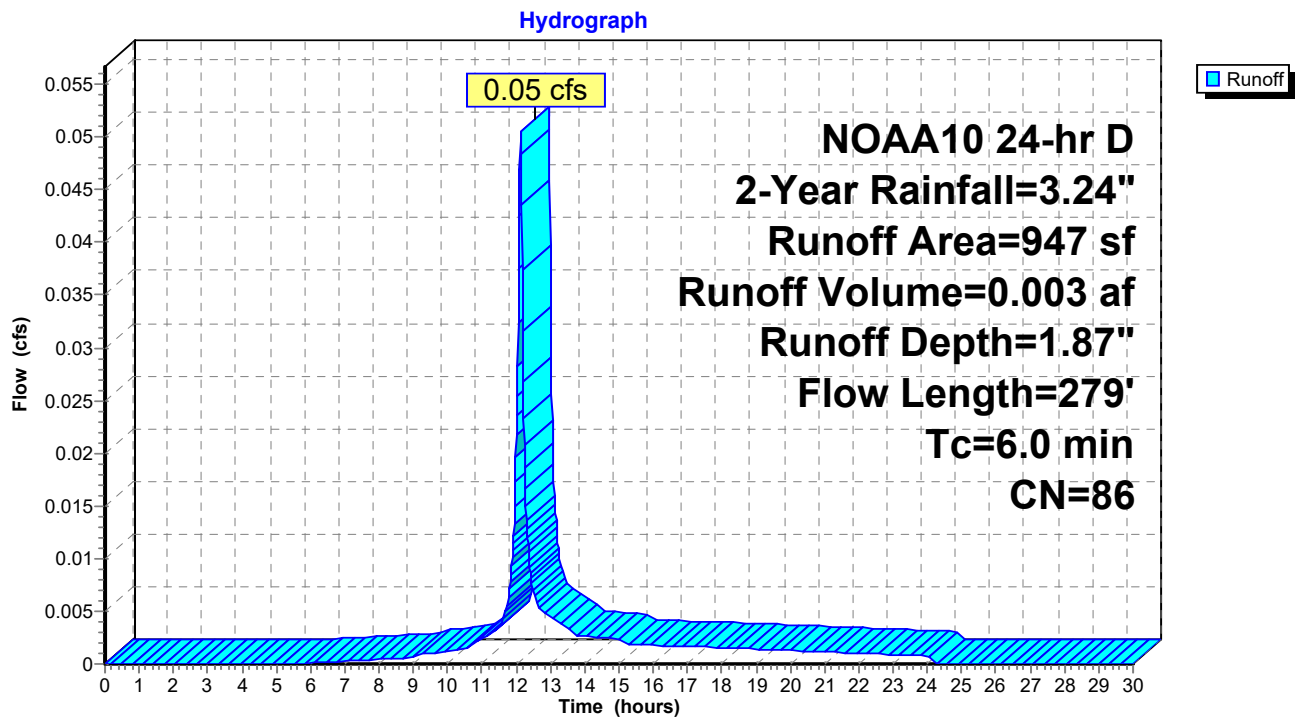
Runoff = 0.05 cfs @ 12.13 hrs, Volume= 0.003 af, Depth= 1.87"

Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
167	39	>75% Grass cover, Good, HSG A
780	96	Gravel surface, HSG A
947	86	Weighted Average
947		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	51	0.0451	0.21		Sheet Flow, Grassed Slope Grass: Short n= 0.150 P2= 3.24"
1.5	205	0.0195	2.25		Shallow Concentrated Flow, Stone Dust Walkway Unpaved Kv= 16.1 fps
0.3	23	0.0098	1.48		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
5.9	279	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S2C-1: Perimeter of Garage

M254459-Redevelopment

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S3: Corner of Oakland & Chestnut (NE)

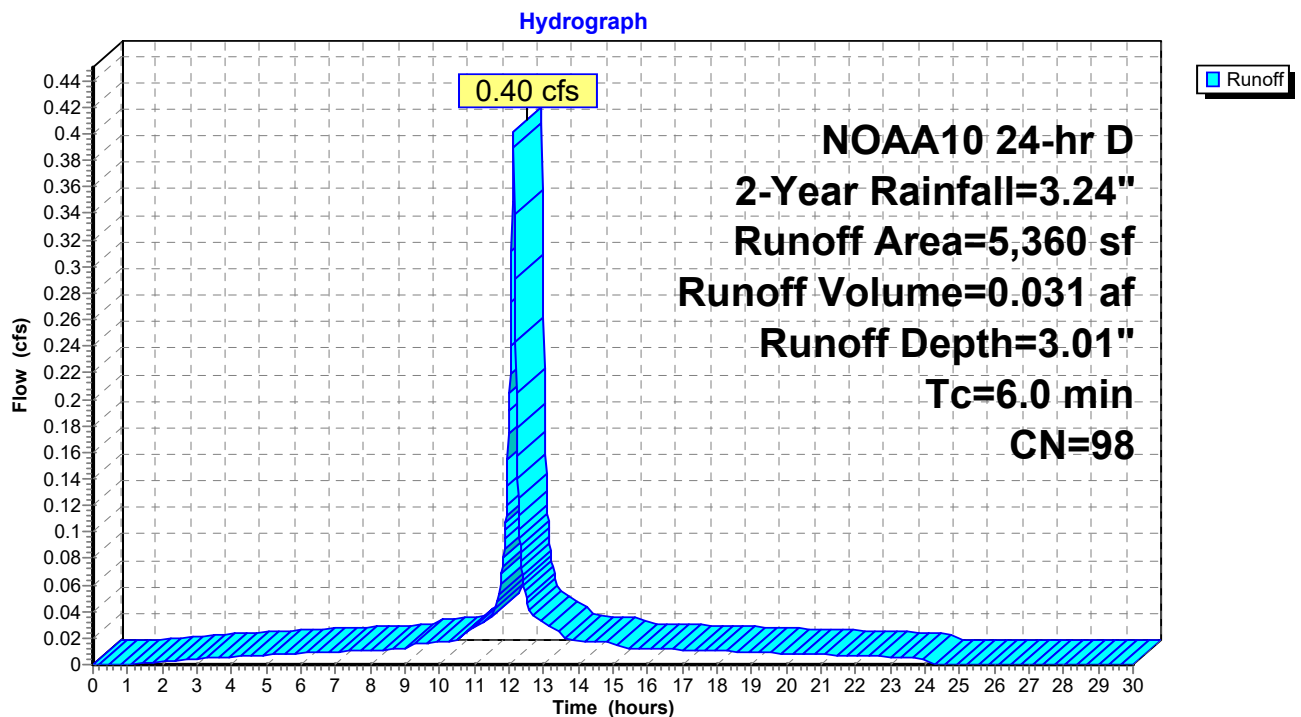
Runoff = 0.40 cfs @ 12.13 hrs, Volume= 0.031 af, Depth= 3.01"

Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
14	39	>75% Grass cover, Good, HSG A
1,053	98	Paved parking, HSG A
4,293	98	Roofs, HSG A
5,360	98	Weighted Average
14		0.26% Pervious Area
5,346		99.74% Impervious Area

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

Subcatchment S3: Corner of Oakland & Chestnut (NE)

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

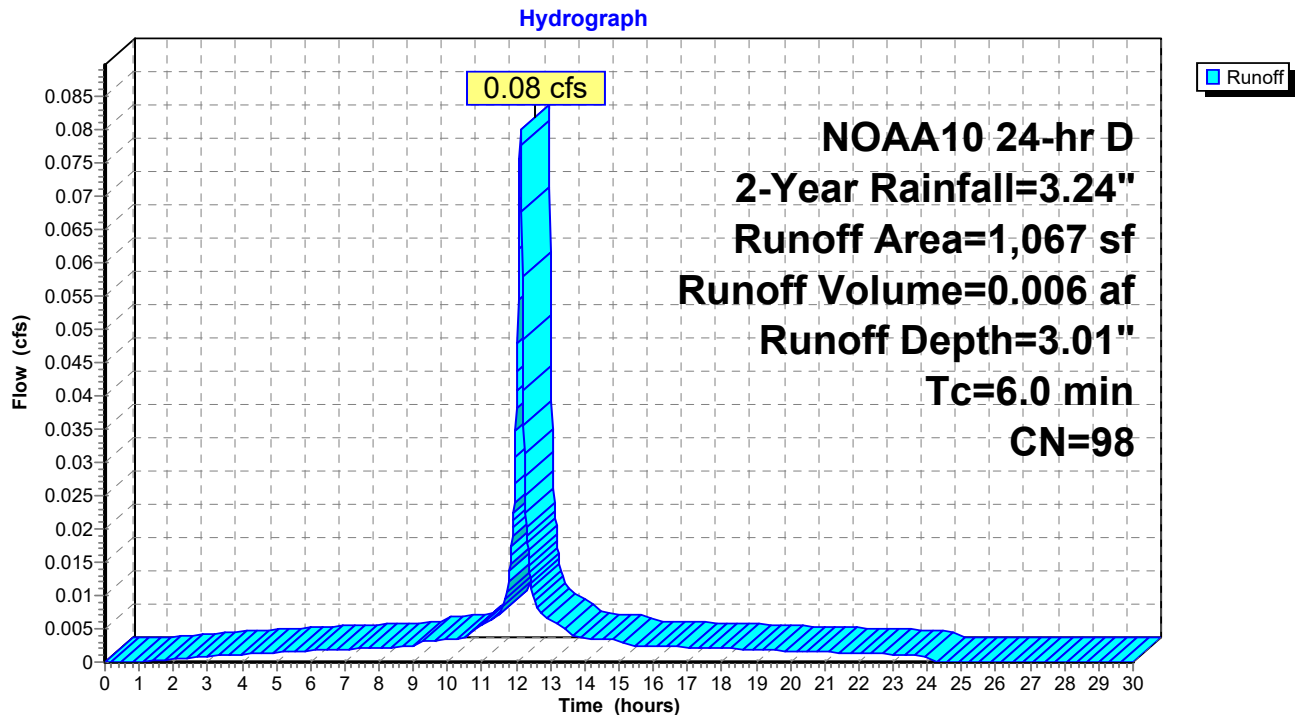
Runoff = 0.08 cfs @ 12.13 hrs, Volume= 0.006 af, Depth= 3.01"

Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
50	96	Gravel surface, HSG A
1,017	98	Paved parking, HSG A
1,067	98	Weighted Average
50		4.69% Pervious Area
1,017		95.31% Impervious Area

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

Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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Summary for Subcatchment S4: Loading Dock

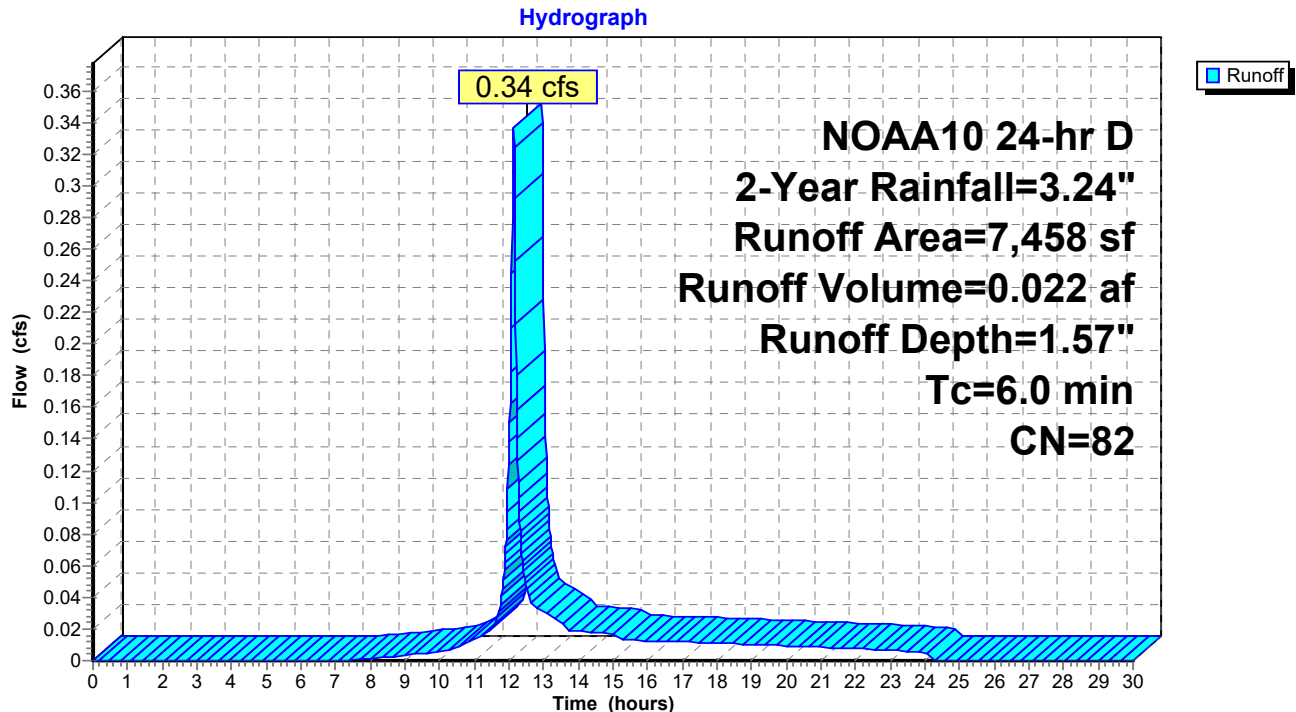
Runoff = 0.34 cfs @ 12.13 hrs, Volume= 0.022 af, Depth= 1.57"

Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
1,421	39	>75% Grass cover, Good, HSG A
2,055	98	Paved parking, HSG A
2,658	98	Roofs, HSG A
1,122	77	Fallow, bare soil, HSG A
202	30	Woods, Good, HSG A
7,458	82	Weighted Average
2,745		36.81% Pervious Area
4,713		63.19% Impervious Area

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

Subcatchment S4: Loading Dock

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Summary for Subcatchment S4-1: Garage Entrance

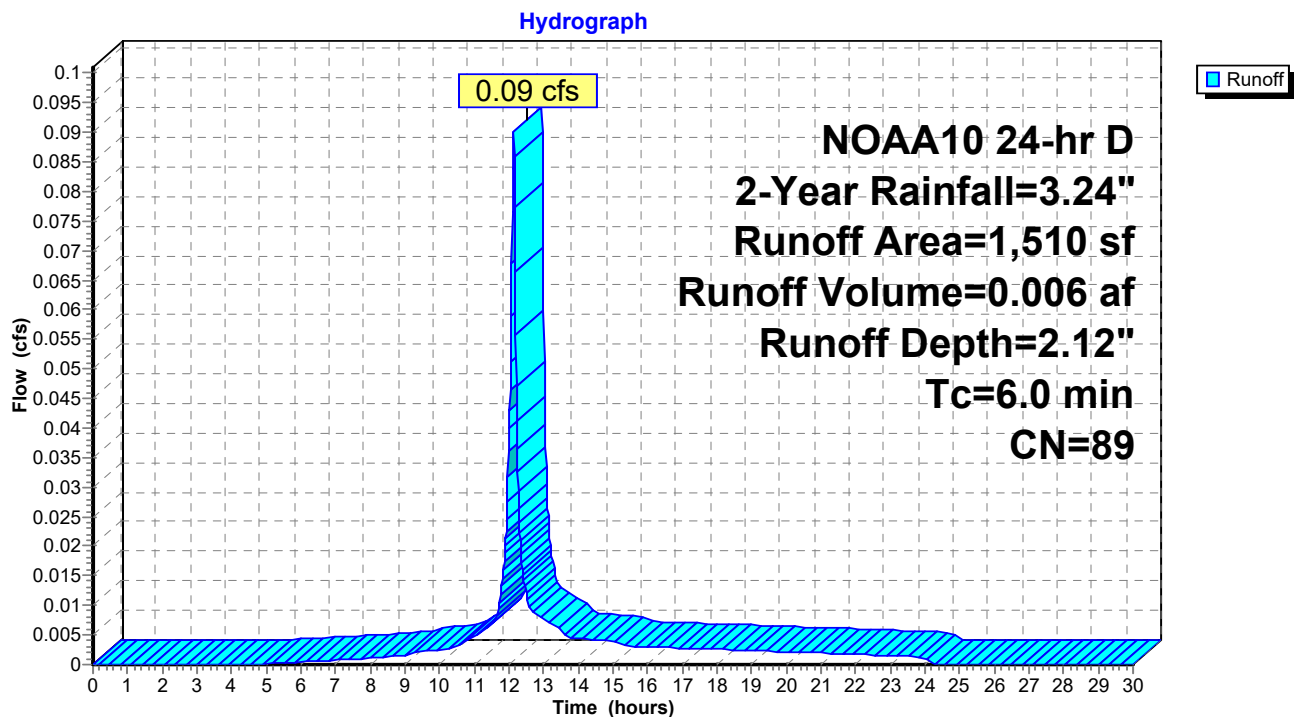
Runoff = 0.09 cfs @ 12.13 hrs, Volume= 0.006 af, Depth= 2.12"

Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
231	39	>75% Grass cover, Good, HSG A
323	96	Gravel surface, HSG A
956	98	Paved parking, HSG A
1,510	89	Weighted Average
554		36.69% Pervious Area
956		63.31% Impervious Area

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

Subcatchment S4-1: Garage Entrance

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NOAA10 24-hr D 2-Year Rainfall=3.24"

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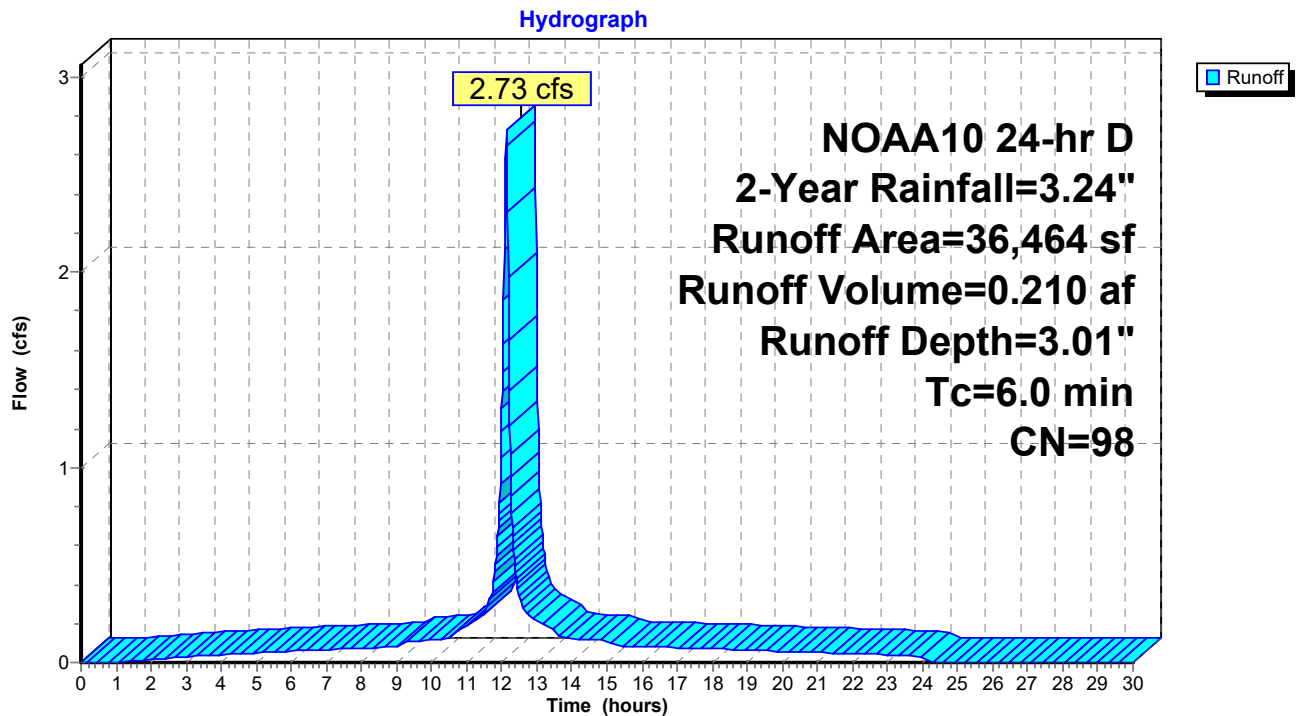
Summary for Subcatchment S4-2: Proposed Roofs

Runoff = 2.73 cfs @ 12.13 hrs, Volume= 0.210 af, Depth= 3.01"
Routed to Pond DC1 : Detention Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
36,464	98	Roofs, HSG A
36,464		100.00% Impervious Area

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

Subcatchment S4-2: Proposed Roofs

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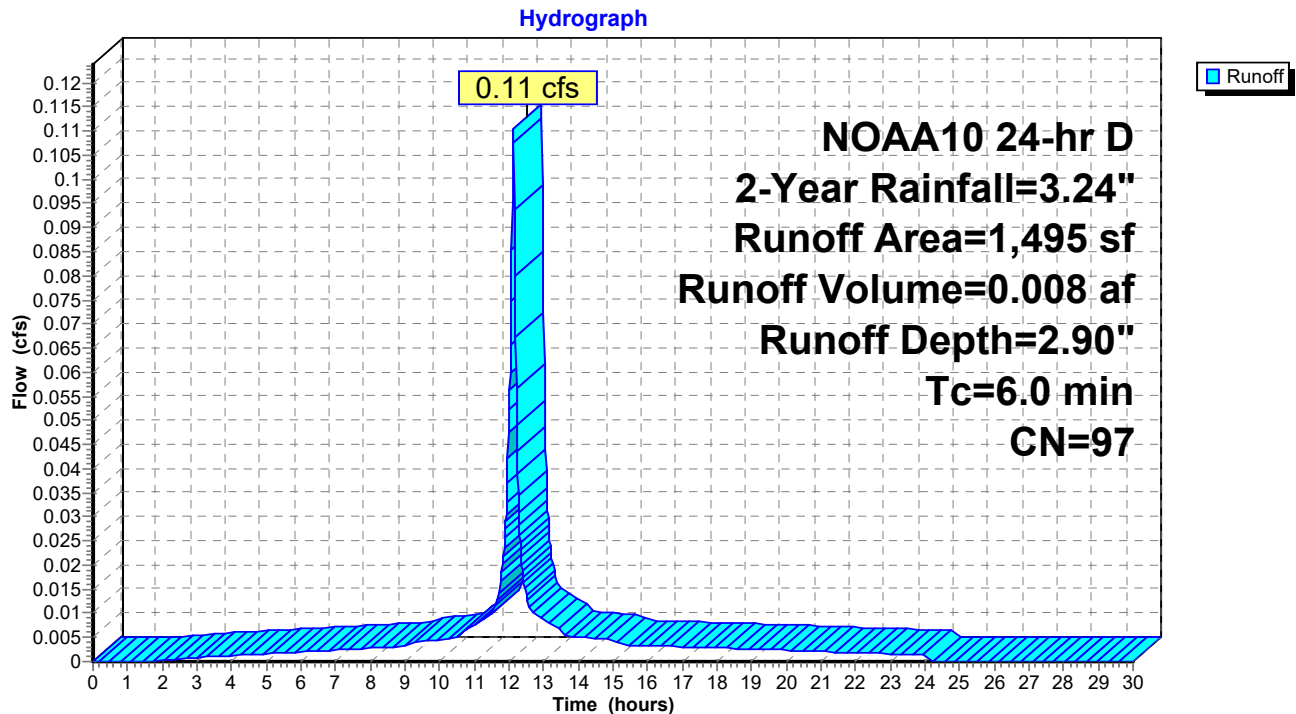
Summary for Subcatchment S4-3: Gap Between Buildings

Runoff = 0.11 cfs @ 12.13 hrs, Volume= 0.008 af, Depth= 2.90"
Routed to Pond GAP : Area Drain

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Area (sf)	CN	Description
559	96	Gravel surface, HSG A
936	98	Unconnected roofs, HSG A
1,495	97	Weighted Average
559		37.39% Pervious Area
936		62.61% Impervious Area
936		100.00% Unconnected

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

Subcatchment S4-3: Gap Between Buildings

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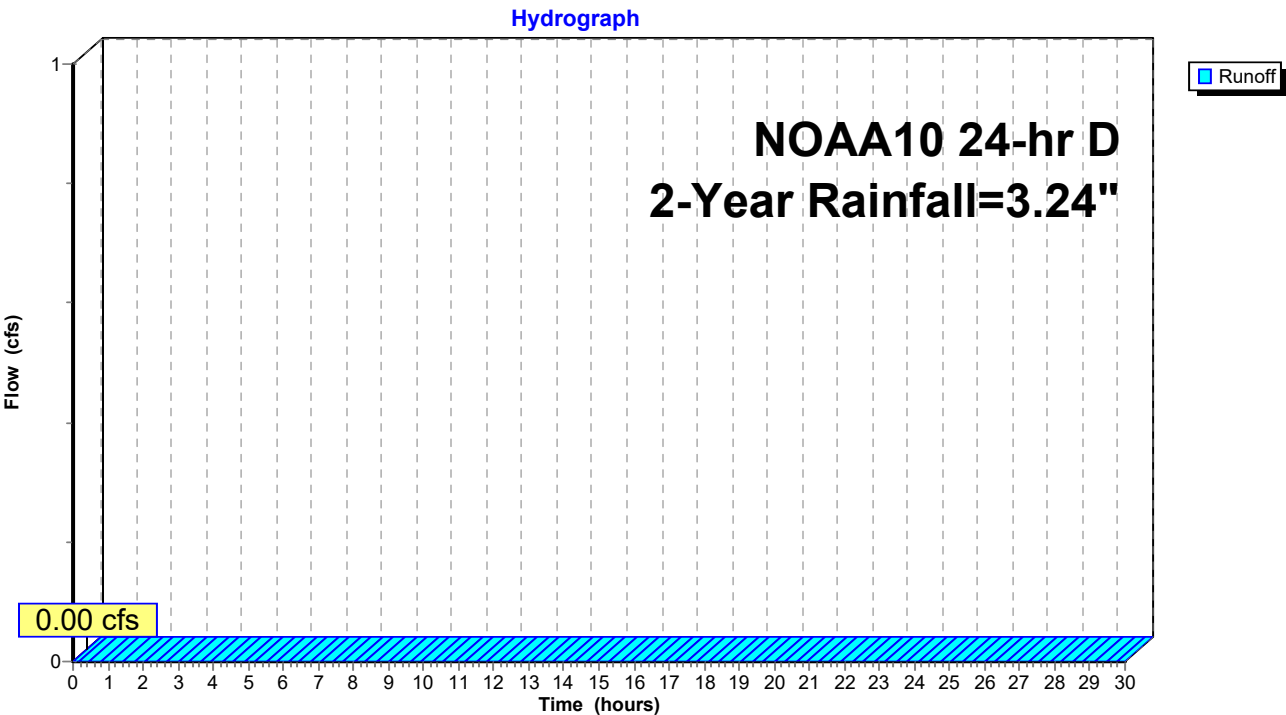
Summary for Subcatchment Tc: Extra Tc Calc's

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 2-Year Rainfall=3.24"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	70	0.0501	5.28	4.15	Pipe Channel, CB 2 to DMH 1 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.1	33	0.1391	8.80	6.91	Pipe Channel, DMH 1 to DMH 2 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.3	139	0.0701	9.18	7.21	Pipe Channel, DMH 2 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
6.3	55	0.0182	0.15		Sheet Flow, Lawn (L2 to DP2) Grass: Short n= 0.150 P2= 3.24"
0.3	27	0.0079	1.33		Shallow Concentrated Flow, Lawn (DP2 to CB 8) Grassed Waterway Kv= 15.0 fps
0.4	47	0.0079	1.80		Shallow Concentrated Flow, Chestnut St. Gutter (DP2 to CB 8) Paved Kv= 20.3 fps
0.0	9	0.0811	9.88	7.76	Pipe Channel, CB 8 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
0.4	143	0.0222	6.77	11.97	Pipe Channel, DMH 3 to DMH 4 18.00" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.017 Concrete sewer w/manholes & inlets
8.0	523	Total			

Subcatchment Tc: Extra Tc Calc's



Summary for Pond CDS1: Water Quality Catch Basin

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 2.58" for 2-Year event
 Inflow = 0.86 cfs @ 12.13 hrs, Volume= 0.061 af
 Outflow = 0.86 cfs @ 12.13 hrs, Volume= 0.061 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.86 cfs @ 12.13 hrs, Volume= 0.061 af
 Routed to Pond IC2 : Infiltration Chamber Under Parking Lot

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 51.70' @ 12.13 hrs

Flood Elev= 52.00'

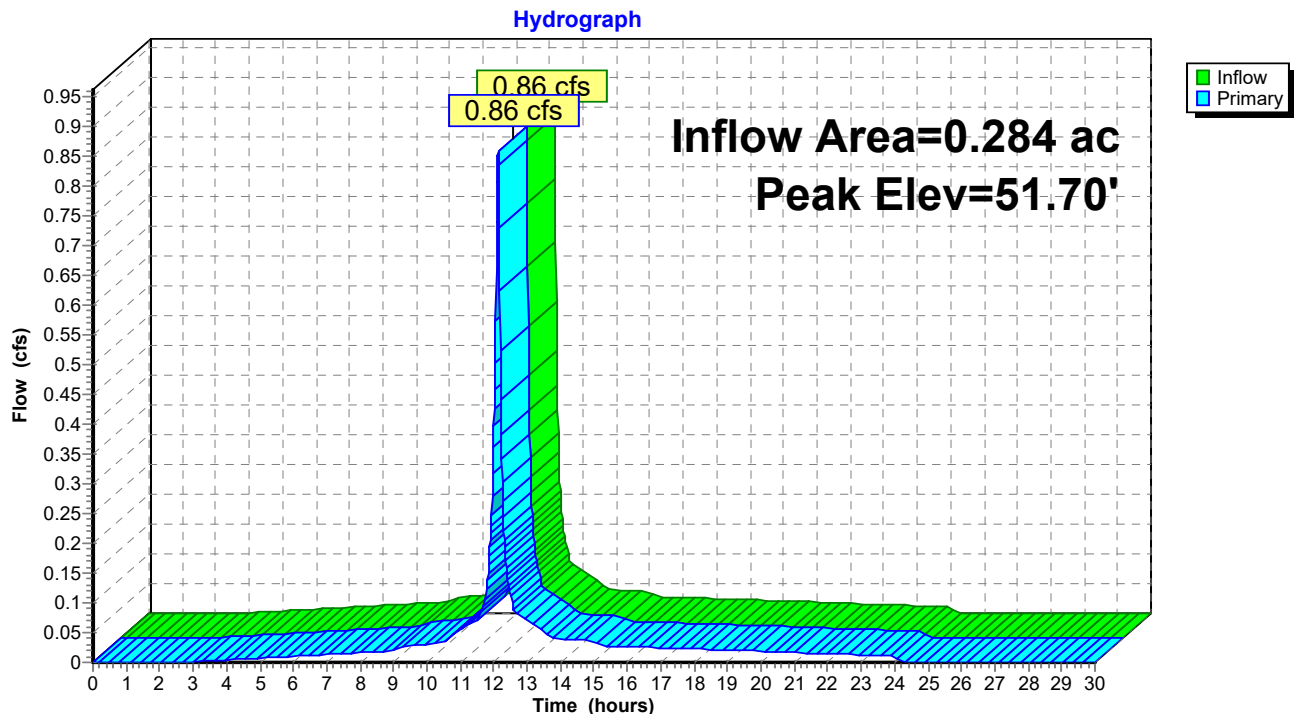
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 ' S= 0.0089 ' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.85 cfs @ 12.13 hrs HW=51.70' TW=49.40' (Dynamic Tailwater)

1=RCP Culvert (SD-3) (Passes 0.85 cfs of 5.73 cfs potential flow)

2=Neenah R1878-A6G Grate (Weir Controls 0.85 cfs @ 1.02 fps)

Pond CDS1: Water Quality Catch Basin



Summary for Pond DC1: Detention Chamber

Inflow Area = 0.871 ac, 98.53% Impervious, Inflow Depth = 3.00" for 2-Year event
 Inflow = 2.85 cfs @ 12.13 hrs, Volume= 0.218 af
 Outflow = 1.63 cfs @ 12.20 hrs, Volume= 0.218 af, Atten= 43%, Lag= 4.3 min
 Primary = 1.63 cfs @ 12.20 hrs, Volume= 0.218 af
 Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 24.91' @ 12.20 hrs Surf.Area= 543 sf Storage= 1,035 cf

Plug-Flow detention time= 16.6 min calculated for 0.218 af (100% of inflow)
 Center-of-Mass det. time= 16.2 min (777.1 - 760.9)

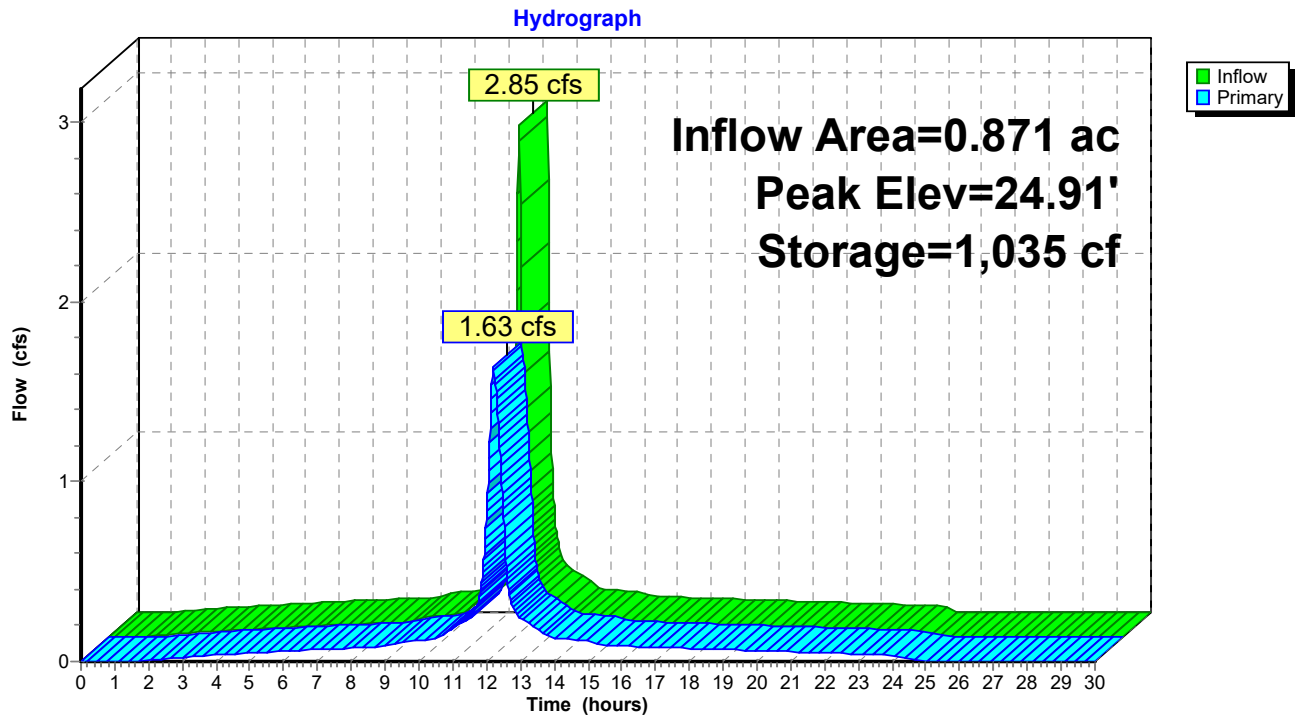
Volume	Invert	Avail.Storage	Storage Description
#1	23.01'	3,217 cf	8.67'W x 15.67'L x 5.92'H Shea Fire Cistern Bankx 4

Device	Routing	Invert	Outlet Devices
#1	Primary	23.01'	12.00" Round RCP Culvert (SD-1) L= 69.4' Ke= 1.800 Inlet / Outlet Invert= 23.01' / 22.66' S= 0.0050 '/ Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	23.01'	7.00" Vert. Control Orifice (2-yr & 10-yr) C= 0.600 Limited to weir flow at low heads
#3	Device 1	27.25'	4.00" Vert. Control Orifice (25-yr) X 4.00 C= 0.600 Limited to weir flow at low heads
#4	Device 1	28.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Primary OutFlow Max=1.63 cfs @ 12.20 hrs HW=24.91' TW=0.00' (Dynamic Tailwater)

- 1=RCP Culvert (SD-1) (Passes 1.63 cfs of 2.40 cfs potential flow)
- 2=Control Orifice (2-yr & 10-yr) (Orifice Controls 1.63 cfs @ 6.11 fps)
- 3=Control Orifice (25-yr) (Controls 0.00 cfs)
- 4=Overflow Orifice (Controls 0.00 cfs)

Pond DC1: Detention Chamber



Summary for Pond DSCB-1: Deep Sump Catch Basin

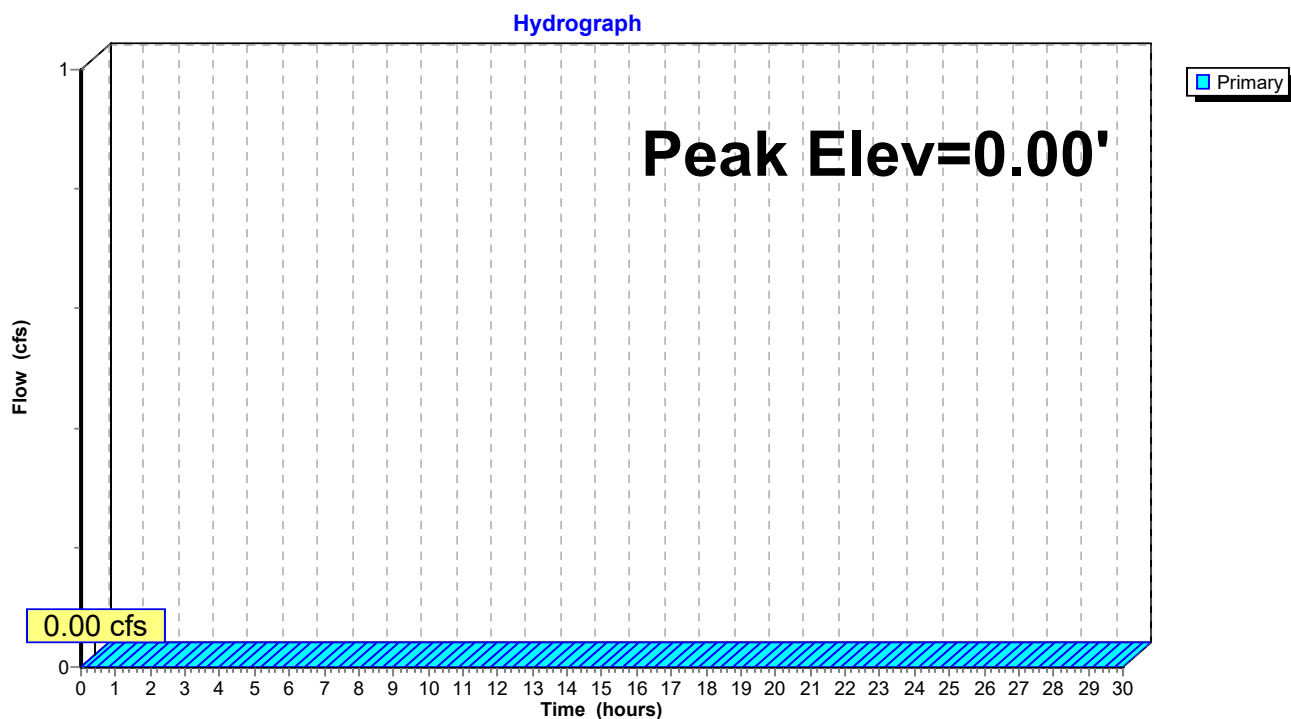
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round Hooded RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 1' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

1=Hooded RCP Culvert (SD-3) (Controls 0.00 cfs)

2=Neenah R1878-A6G Grate (Controls 0.00 cfs)

Pond DSCB-1: Deep Sump Catch Basin



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Summary for Pond GAP: Area Drain

Inflow Area = 0.034 ac, 62.61% Impervious, Inflow Depth = 2.90" for 2-Year event
 Inflow = 0.11 cfs @ 12.13 hrs, Volume= 0.008 af
 Outflow = 0.11 cfs @ 12.13 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.11 cfs @ 12.13 hrs, Volume= 0.008 af
 Routed to Pond DC1 : Detention Chamber

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 54.50' @ 12.13 hrs Storage= 0 cf

Flood Elev= 55.00' Storage= 112 cf

Plug-Flow detention time= 0.0 min calculated for 0.008 af (100% of inflow)

Center-of-Mass det. time= 0.0 min (772.4 - 772.4)

Volume	Invert	Avail.Storage	Storage Description	
#1	54.50'	2,068 cf	Open Area (Prismatic) Listed below -Impervious	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.50	559	0.0	0	0
55.00	559	40.0	112	112
58.50	559	100.0	1,957	2,068

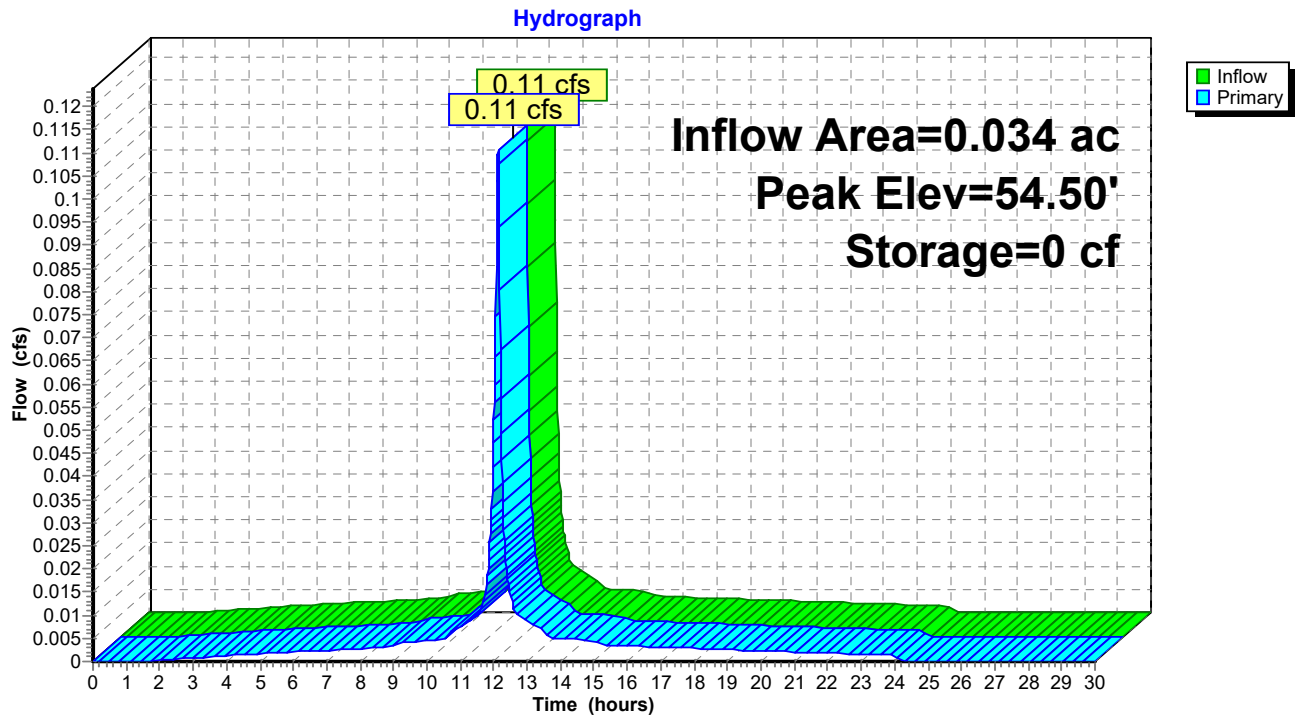
Device	Routing	Invert	Outlet Devices
#1	Primary	26.00'	6.00" Round Ductile Iron Drain Pipe (SD-4) L= 27.6' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.00' / 25.00' S= 0.0362 ' / ' Cc= 0.900 n= 0.014 Steel, smooth, Flow Area= 0.20 sf
#2	Device 1	54.50'	2.00" x 2.00" Horiz. Neenah R-3203-A Inlet Grate X 6.00 columns X 6 rows C= 0.600 in 20.00" x 20.00" Grate (36% open area)

Primary OutFlow Max=0.11 cfs @ 12.13 hrs HW=54.50' TW=24.55' (Dynamic Tailwater)

1=Ductile Iron Drain Pipe (SD-4) (Passes 0.11 cfs of 4.23 cfs potential flow)

2=Neenah R-3203-A Inlet Grate (Orifice Controls 0.11 cfs @ 0.11 fps)

Pond GAP: Area Drain



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Summary for Pond IC1: Infiltration Chamber Under Garage

Volume	Invert	Avail.Storage	Storage Description
#1A	22.73'	450 cf	50.00'W x 16.00'L x 6.17'H Field A 4,936 cf Overall - 3,810 cf Embedded = 1,126 cf x 40.0% Voids
#2A	23.23'	3,000 cf	Shea Leaching Chamber 8x14x5.7 x 6 Inside #1 Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf 6 Chambers in 6 Rows
		3,450 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.73'	25.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 15.00' Phase-In= 0.08'
#2	Primary	24.55'	12.00" Round RCP Culvert (SD-1) L= 70.7' Ke= 1.800 Inlet / Outlet Invert= 24.55' / 24.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	24.55'	4.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	27.60'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)↑ **1=Exfiltration** (Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)↑ **2=RCP Culvert (SD-1)** (Controls 0.00 cfs)↑ **3=Control Orifice** (Controls 0.00 cfs)↑ **4=Overflow Orifice** (Controls 0.00 cfs)

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Pond IC1: Infiltration Chamber Under Garage - Chamber Wizard Field A

Chamber Model = Shea Leaching Chamber 8x14x5.7 (Shea Galley)

Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf

Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf

1 Chambers/Row x 14.00' Long = 14.00' Row Length +12.0" End Stone x 2 = 16.00' Base Length

6 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 50.00' Base Width

6.0" Stone Base + 68.0" Chamber Height = 6.17' Field Height

6 Chambers x 500.0 cf = 3,000.0 cf Chamber Storage

6 Chambers x 635.0 cf = 3,810.2 cf Displacement

4,936.0 cf Field - 3,810.2 cf Chambers = 1,125.8 cf Stone x 40.0% Voids = 450.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,450.3 cf = 0.079 af

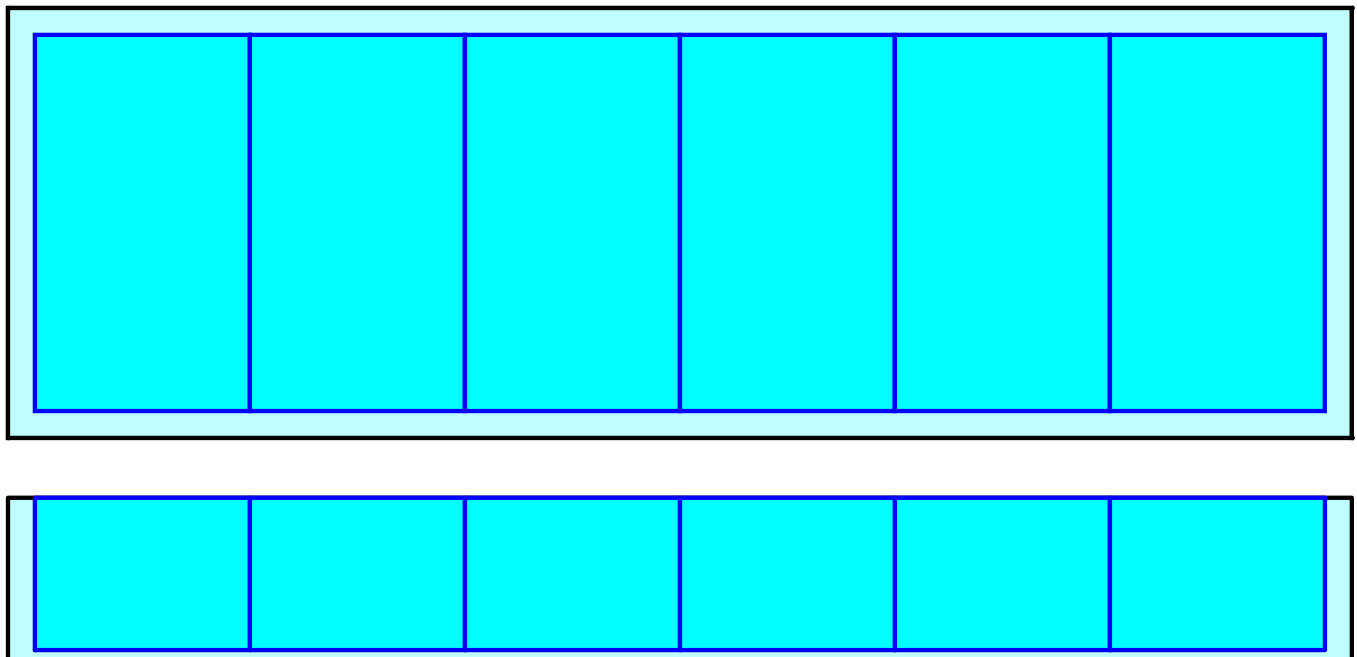
Overall Storage Efficiency = 69.9%

Overall System Size = 16.00' x 50.00' x 6.17'

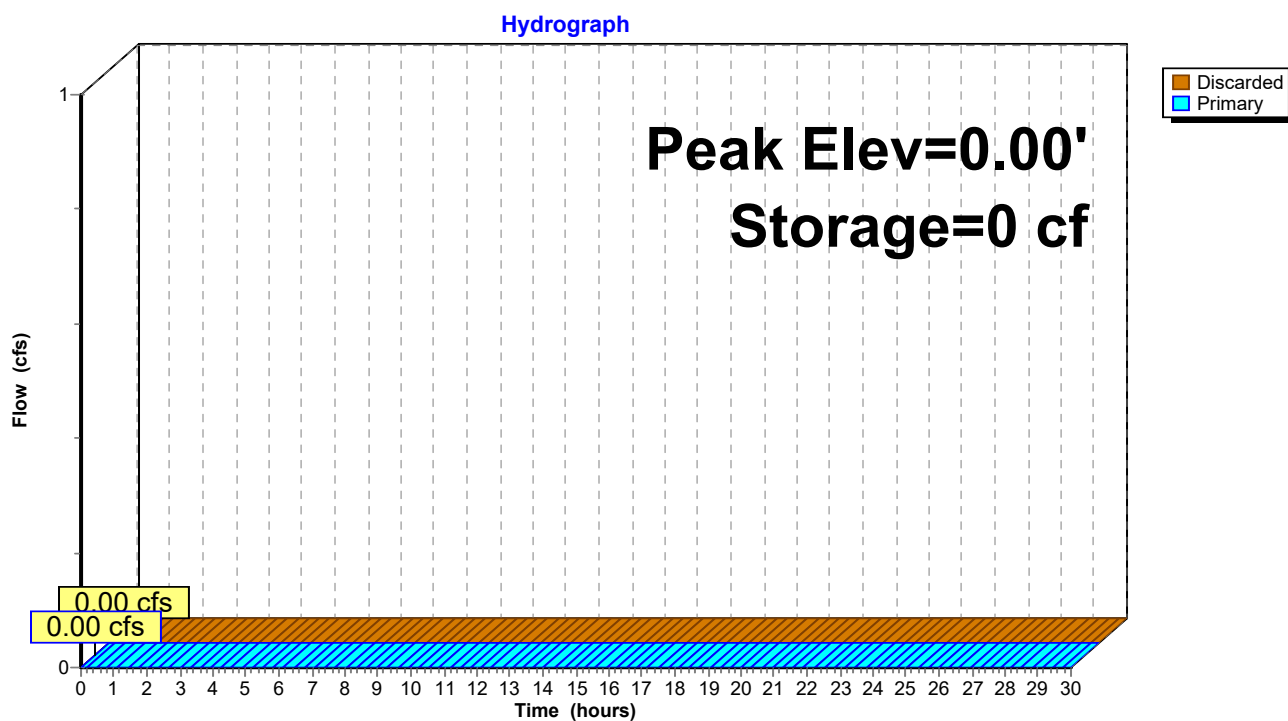
6 Chambers

182.8 cy Field

41.7 cy Stone



Pond IC1: Infiltration Chamber Under Garage



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Summary for Pond IC2: Infiltration Chamber Under Parking Lot

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 2.58" for 2-Year event
 Inflow = 0.86 cfs @ 12.13 hrs, Volume= 0.061 af
 Outflow = 0.37 cfs @ 12.23 hrs, Volume= 0.061 af, Atten= 57%, Lag= 6.1 min
 Discarded = 0.07 cfs @ 12.23 hrs, Volume= 0.053 af
 Primary = 0.30 cfs @ 12.23 hrs, Volume= 0.008 af
 Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 49.71' @ 12.23 hrs Surf.Area= 540 sf Storage= 600 cf

Plug-Flow detention time= 43.8 min calculated for 0.061 af (100% of inflow)
 Center-of-Mass det. time= 43.8 min (843.7 - 799.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	48.08'	206 cf	18.00'W x 30.00'L x 3.17'H Field A 1,712 cf Overall - 1,196 cf Embedded = 516 cf x 40.0% Voids
#2A	48.58'	800 cf	Shea Leaching Chamber 8x14x2.7 x 4 Inside #1 Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf 4 Chambers in 2 Rows
		1,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.08'	4.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 17.50' Phase-In= 0.08'
#2	Primary	49.33'	12.00" Round RCP Culvert (SD-2) L= 53.0' Ke= 1.800 Inlet / Outlet Invert= 49.33' / 48.00' S= 0.0251 ' /' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	49.33'	9.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	50.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.23 hrs HW=49.70' (Free Discharge)
 ↳ **1=Exfiltration** (Controls 0.07 cfs)

Primary OutFlow Max=0.30 cfs @ 12.23 hrs HW=49.70' TW=0.00' (Dynamic Tailwater)
 ↳ **2=RCP Culvert (SD-2)** (Inlet Controls 0.30 cfs @ 1.12 fps)
 ↳ **3=Control Orifice** (Passes 0.30 cfs of 0.46 cfs potential flow)
 ↳ **4=Overflow Orifice** (Controls 0.00 cfs)

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Pond IC2: Infiltration Chamber Under Parking Lot - Chamber Wizard Field A

Chamber Model = Shea Leaching Chamber 8x14x2.7 (Shea Galley)

Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf

Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf

2 Chambers/Row x 14.00' Long = 28.00' Row Length +12.0" End Stone x 2 = 30.00' Base Length

2 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 18.00' Base Width

6.0" Stone Base + 32.0" Chamber Height = 3.17' Field Height

4 Chambers x 200.0 cf = 800.0 cf Chamber Storage

4 Chambers x 299.0 cf = 1,196.2 cf Displacement

1,711.8 cf Field - 1,196.2 cf Chambers = 515.6 cf Stone x 40.0% Voids = 206.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,006.3 cf = 0.023 af

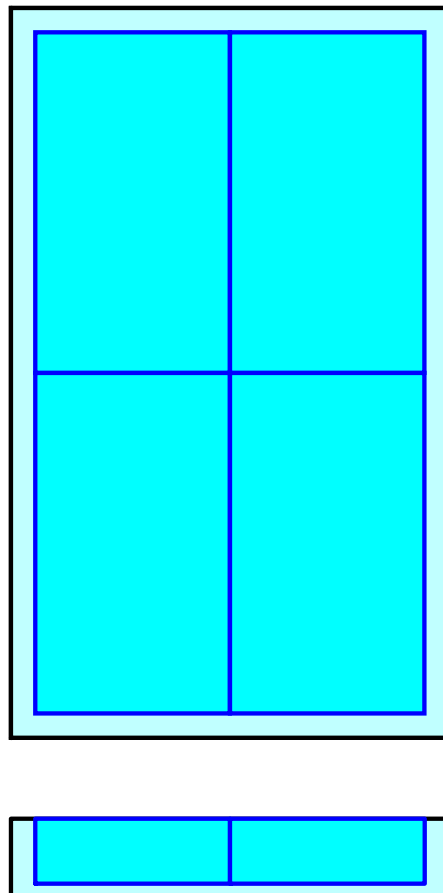
Overall Storage Efficiency = 58.8%

Overall System Size = 30.00' x 18.00' x 3.17'

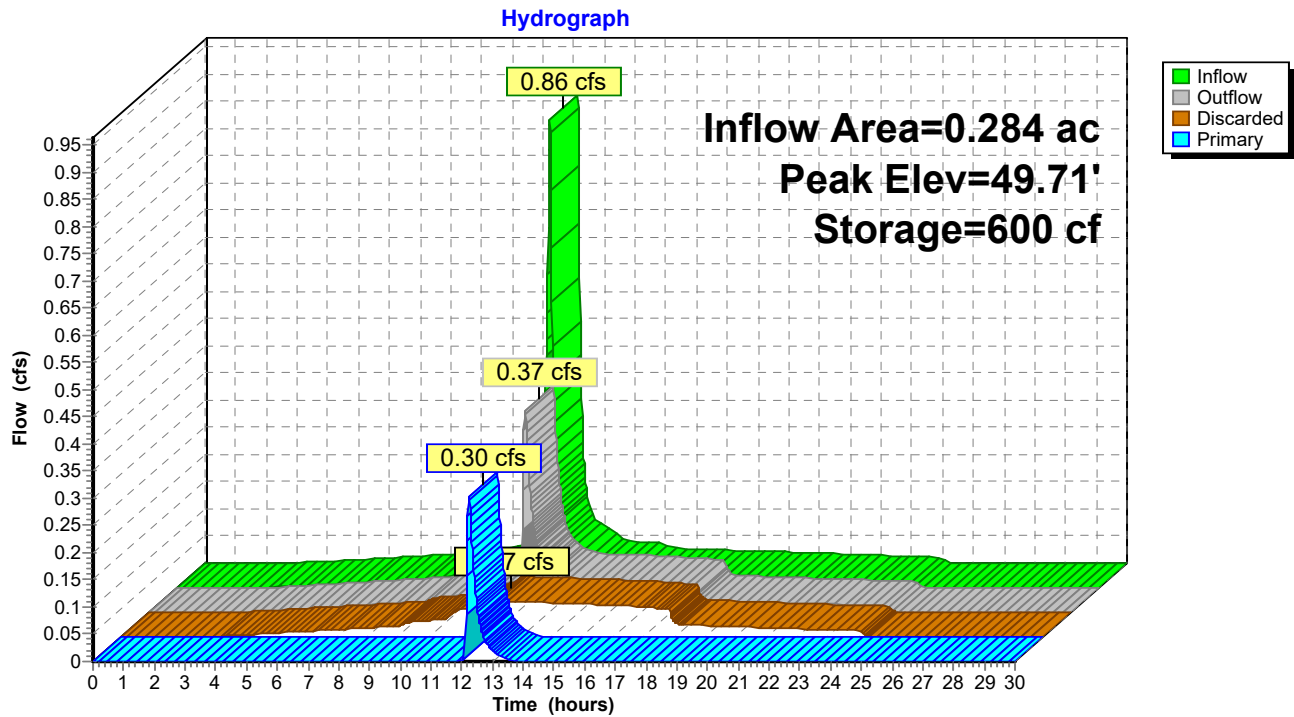
4 Chambers

63.4 cy Field

19.1 cy Stone



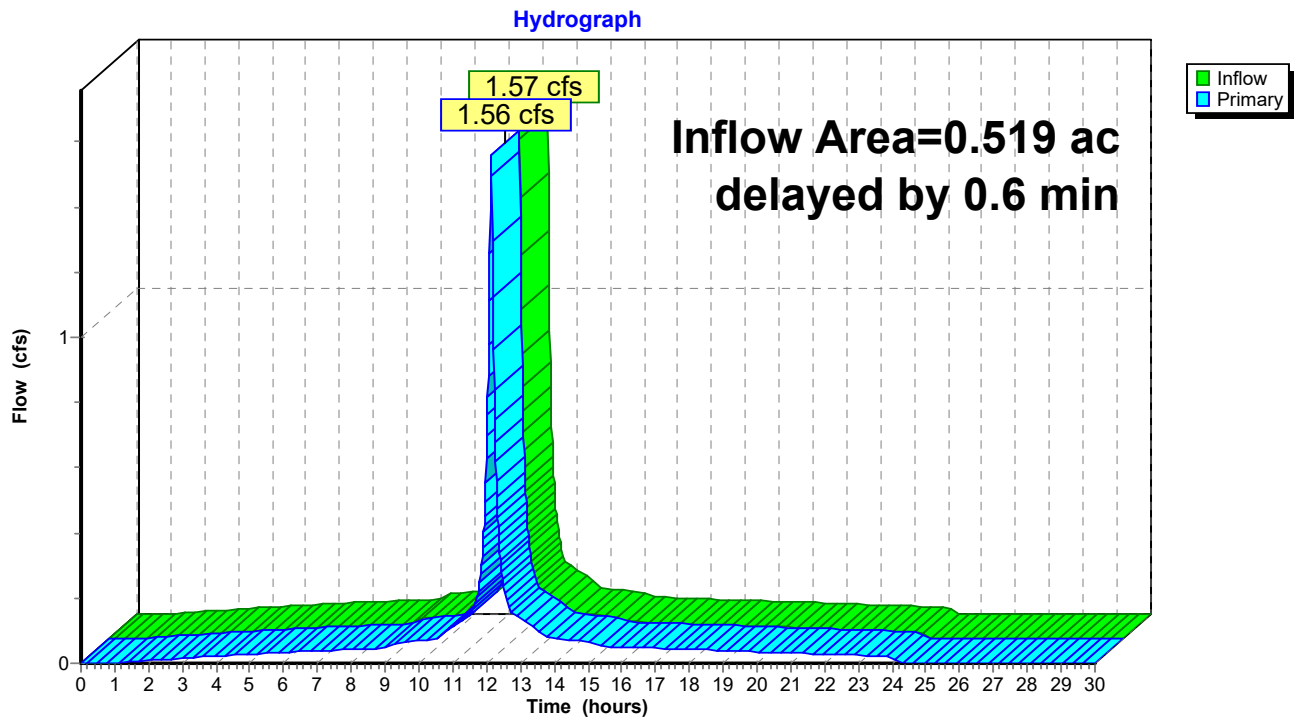
Pond IC2: Infiltration Chamber Under Parking Lot



Summary for Link DP1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.519 ac, 98.58% Impervious, Inflow Depth = 2.92" for 2-Year event
Inflow = 1.57 cfs @ 12.13 hrs, Volume= 0.126 af
Primary = 1.56 cfs @ 12.14 hrs, Volume= 0.126 af, Atten= 1%, Lag= 0.6 min
Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

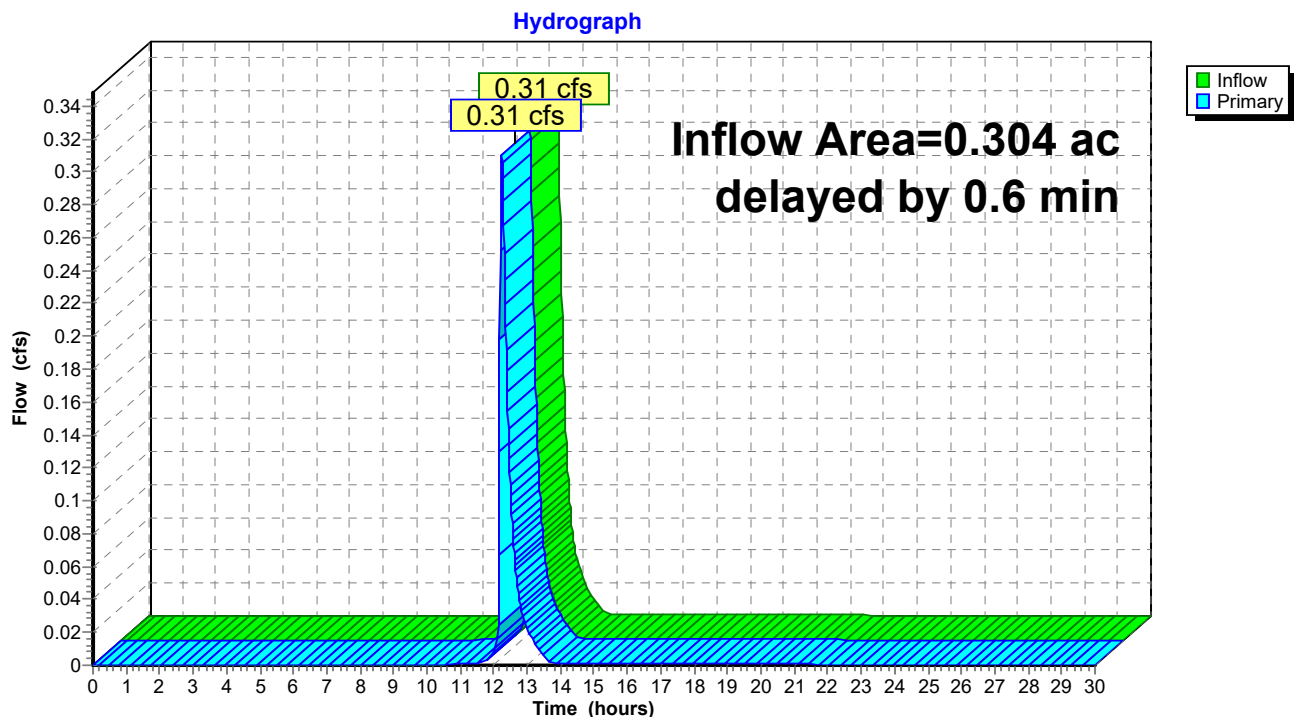
Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP1: Oakland St. Catch Basin (CB 2)

Summary for Link DP1-1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.304 ac, 81.38% Impervious, Inflow Depth = 0.38" for 2-Year event
Inflow = 0.31 cfs @ 12.23 hrs, Volume= 0.010 af
Primary = 0.31 cfs @ 12.24 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.7 min
Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

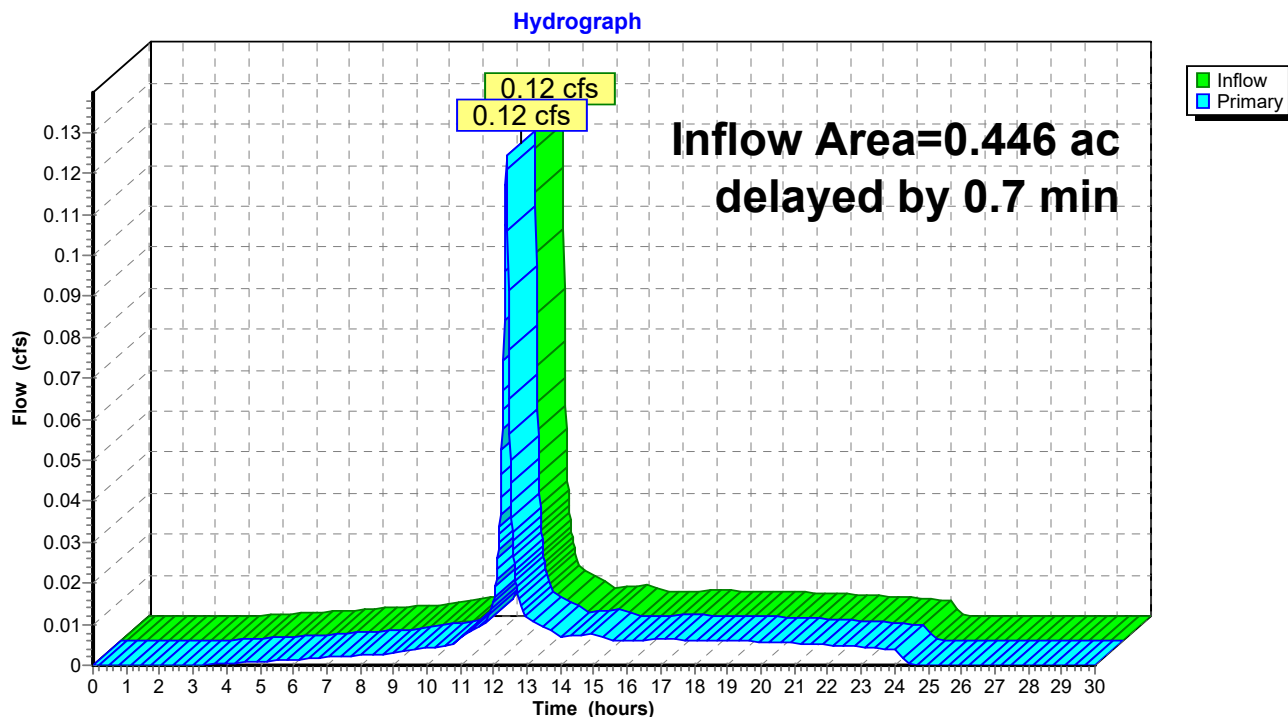
Link DP1-1: Oakland St. Catch Basin (CB 2)

Summary for Link DP2: Overland to City Drain (CB 8) via Lot 97

Inflow Area = 0.446 ac, 30.85% Impervious, Inflow Depth = 0.30" for 2-Year event
 Inflow = 0.12 cfs @ 12.37 hrs, Volume= 0.011 af
 Primary = 0.12 cfs @ 12.38 hrs, Volume= 0.011 af, Atten= 0%, Lag= 0.7 min
 Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

Primary outflow = Inflow delayed by 0.7 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP2: Overland to City Drain (CB 8) via Lot 97



Inflow Area = 0.024 ac, 0.00% Impervious, Inflow Depth = 1.66" for 2-Year event
Inflow = 0.05 cfs @ 12.13 hrs, Volume= 0.003 af
Primary = 0.05 cfs @ 12.14 hrs, Volume= 0.003 af, Atten= 1%, Lag= 0.7 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Hydrograph

Flow (cfs)

Time (hours)

0.05 cfs

0.05 cfs

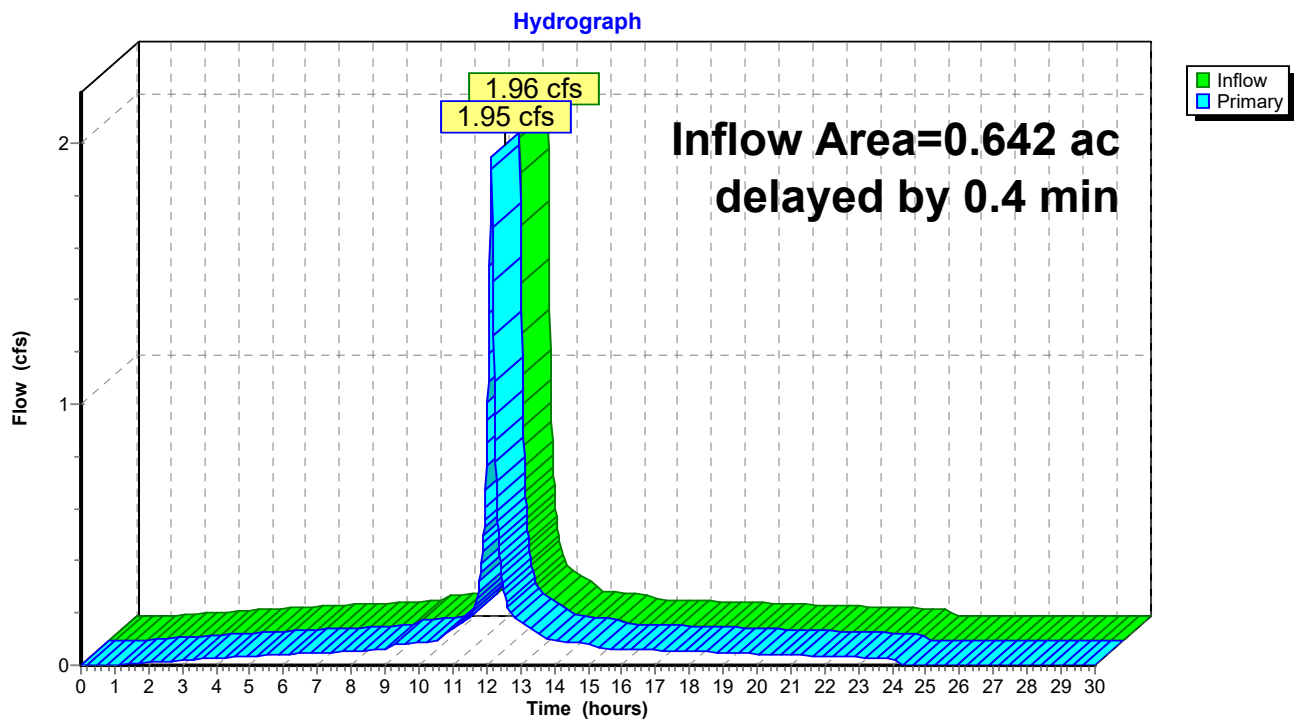
Inflow Area=0.024 ac
delayed by 0.7 min

Legend: Inflow (green), Primary (blue)

Summary for Link DP3: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.642 ac, 98.80% Impervious, Inflow Depth = 2.94" for 2-Year event
Inflow = 1.96 cfs @ 12.14 hrs, Volume= 0.157 af
Primary = 1.95 cfs @ 12.14 hrs, Volume= 0.157 af, Atten= 1%, Lag= 0.4 min
Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

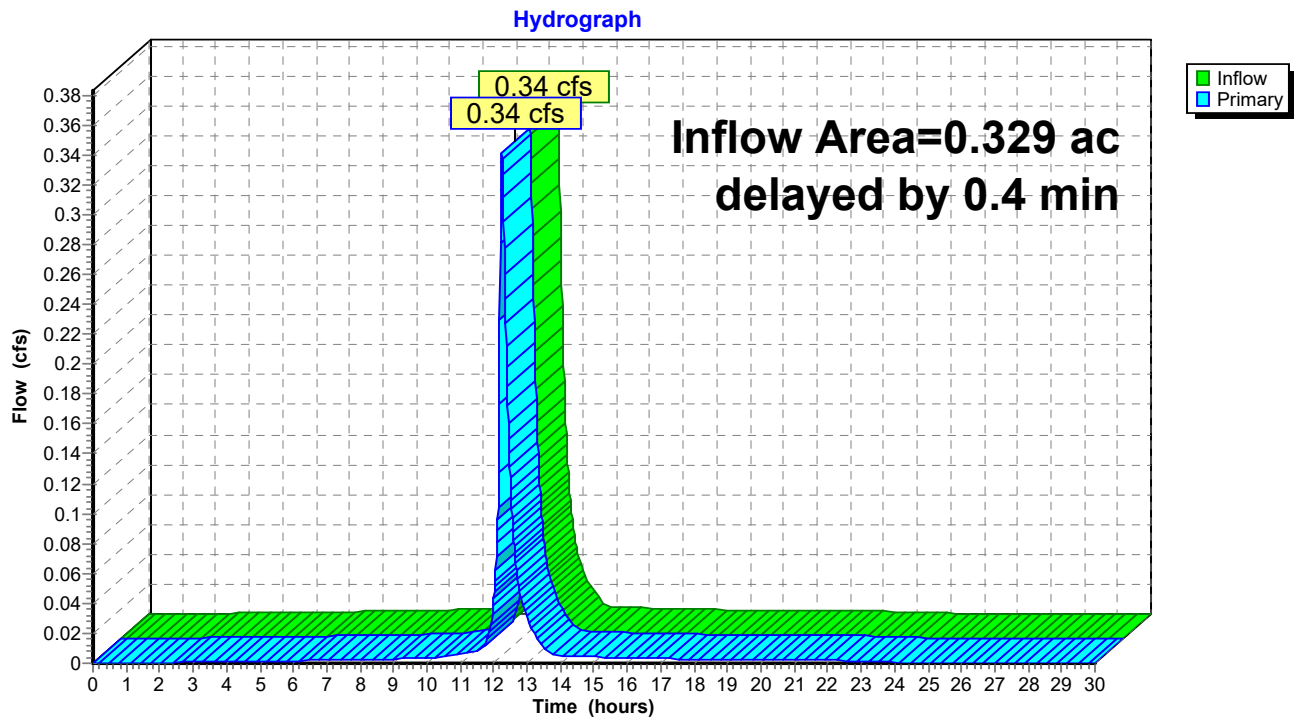
Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3: Chestnut St. Drain Manhole (DMH 3)

Summary for Link DP3-1: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.329 ac, 82.42% Impervious, Inflow Depth = 0.58" for 2-Year event
Inflow = 0.34 cfs @ 12.23 hrs, Volume= 0.016 af
Primary = 0.34 cfs @ 12.24 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.5 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

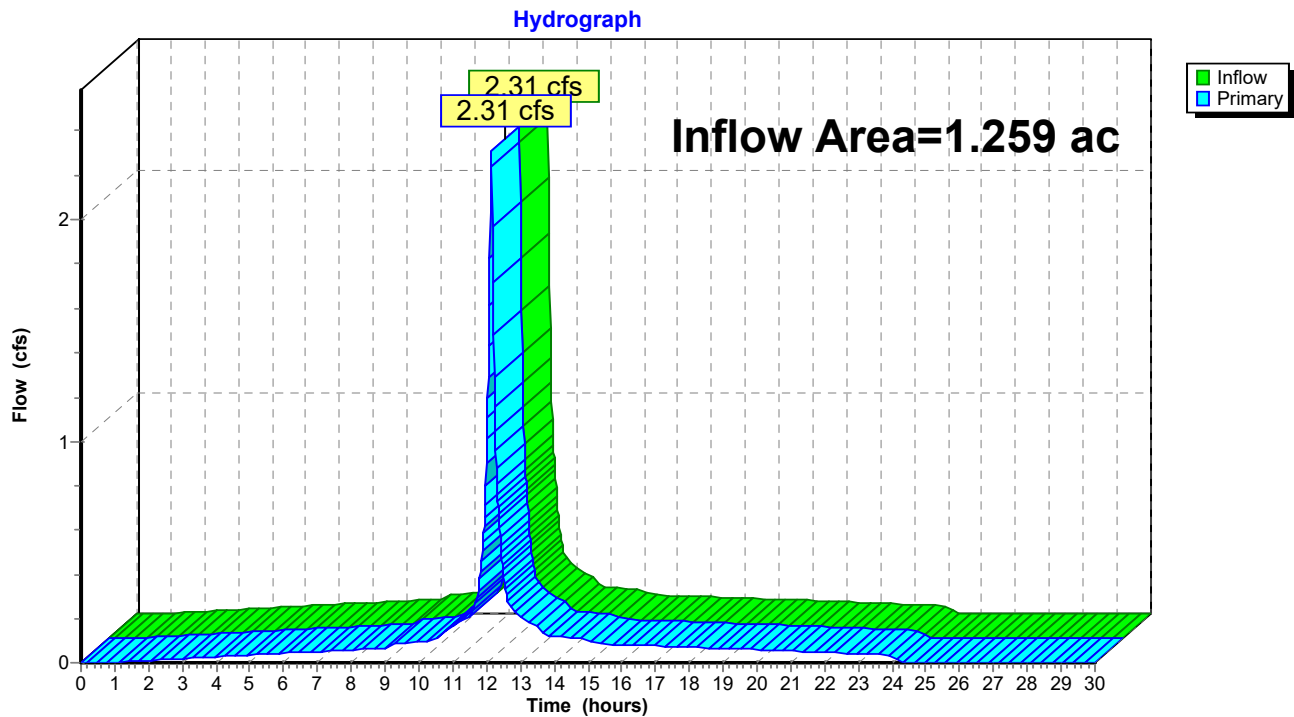
Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3-1: Chestnut St. Drain Manhole (DMH 3)

Summary for Link DP4: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 69.90% Impervious, Inflow Depth = 1.82" for 2-Year event
Inflow = 2.31 cfs @ 12.14 hrs, Volume= 0.191 af
Primary = 2.31 cfs @ 12.14 hrs, Volume= 0.191 af, Atten= 0%, Lag= 0.0 min

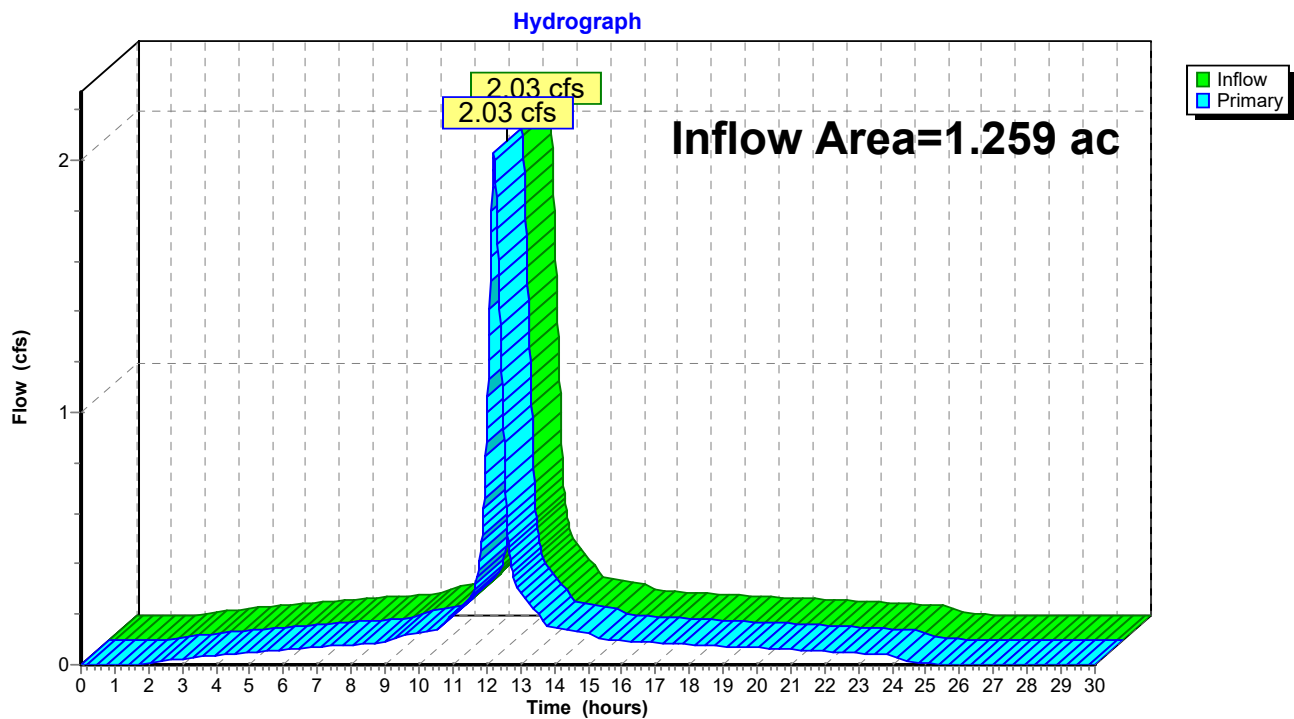
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP4: Chestnut St. Drain Manhole (DMH 4)

Summary for Link DP4-1: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 91.44% Impervious, Inflow Depth > 2.32" for 2-Year event
Inflow = 2.03 cfs @ 12.21 hrs, Volume= 0.243 af
Primary = 2.03 cfs @ 12.21 hrs, Volume= 0.243 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

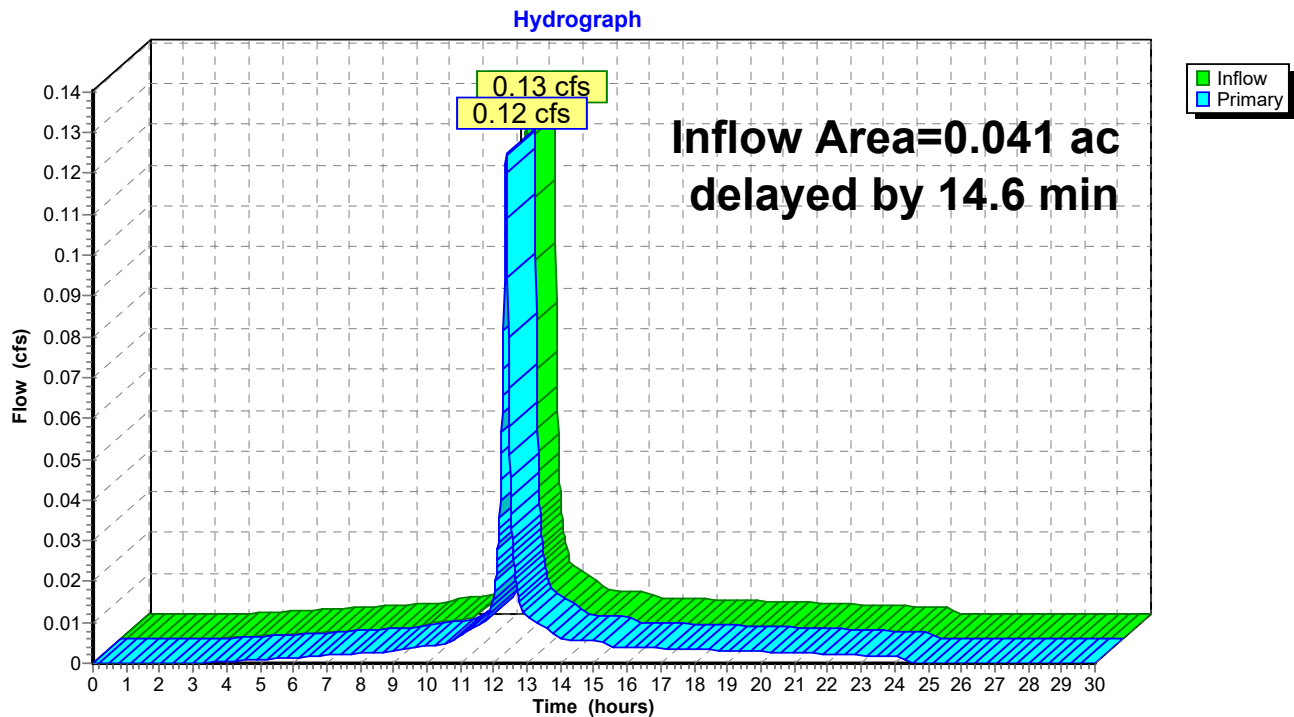
Link DP4-1: Chestnut St. Drain Manhole (DMH 4)

Summary for Link L2: Lag Time for Flow from S2B to DP2

Inflow Area = 0.041 ac, 93.46% Impervious, Inflow Depth = 2.58" for 2-Year event
 Inflow = 0.13 cfs @ 12.13 hrs, Volume= 0.009 af
 Primary = 0.12 cfs @ 12.37 hrs, Volume= 0.009 af, Atten= 0%, Lag= 14.6 min
 Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 14.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link L2: Lag Time for Flow from S2B to DP2

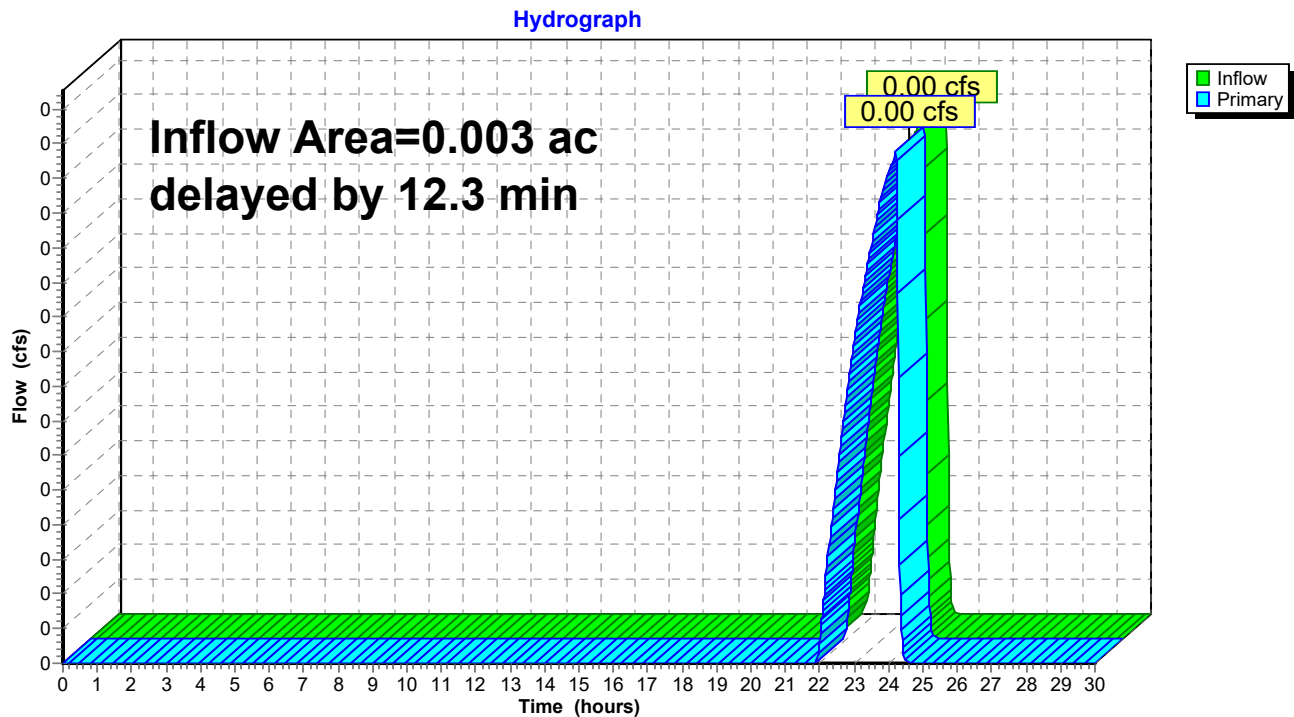


Summary for Link L2-1: Lag Time for Flow from S2B-1 to DP2-1

Inflow Area = 0.003 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
 Inflow = 0.00 cfs @ 24.02 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 24.21 hrs, Volume= 0.000 af, Atten= 0%, Lag= 11.5 min
 Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 12.3 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link L2-1: Lag Time for Flow from S2B-1 to DP2-1



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NOAA10 24-hr D 10-Year Rainfall=5.12"

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Summary for Subcatchment S1: Parking & Front of Buildings

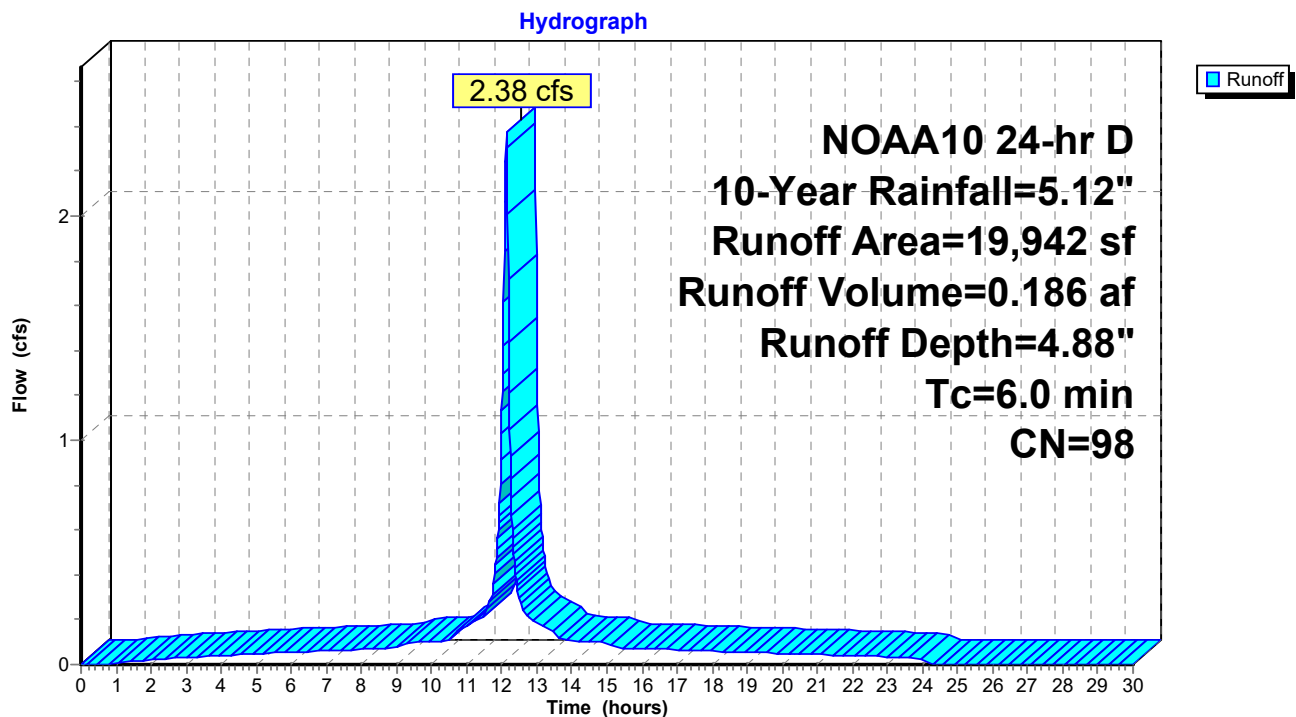
Runoff = 2.38 cfs @ 12.13 hrs, Volume= 0.186 af, Depth= 4.88"

Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
12,479	98	Paved parking, HSG A
7,463	98	Roofs, HSG A
19,942	98	Weighted Average
19,942		100.00% Impervious Area

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

Subcatchment S1: Parking & Front of Buildings

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Summary for Subcatchment S1-1: Drains to Parking Lot Chambers

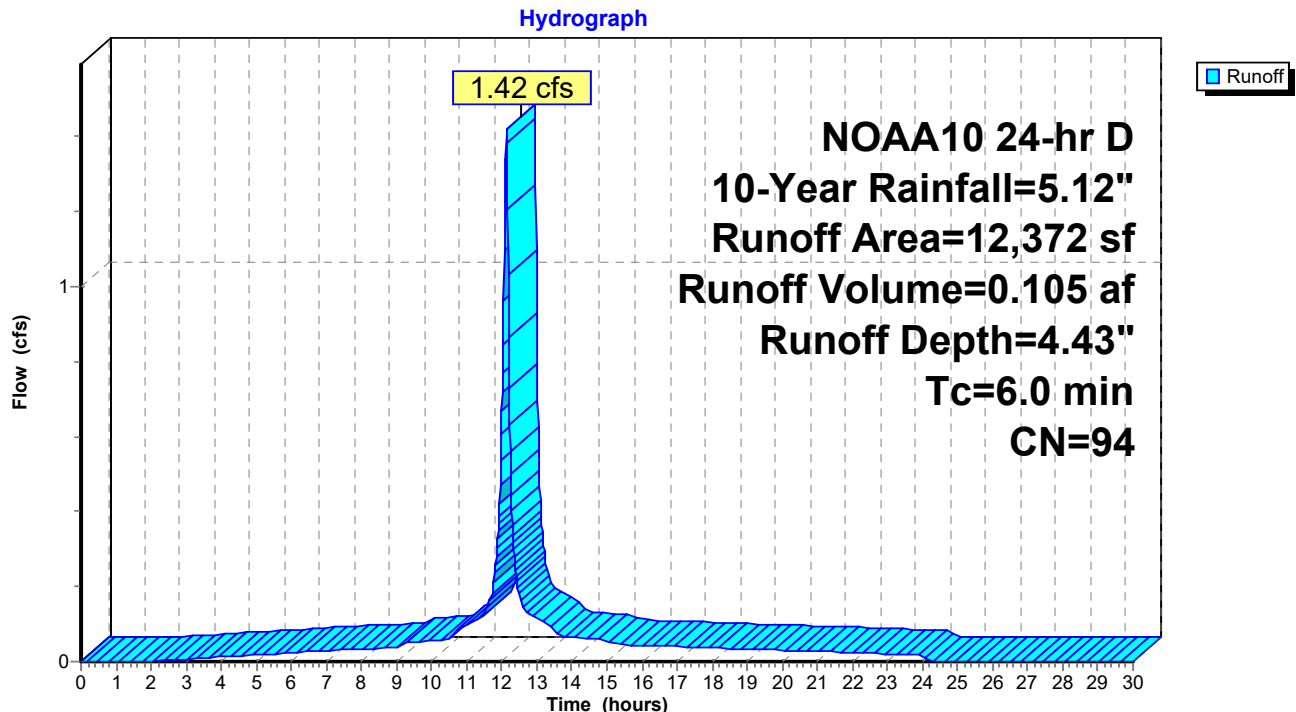
Runoff = 1.42 cfs @ 12.13 hrs, Volume= 0.105 af, Depth= 4.43"

Routed to Pond CDS1 : Water Quality Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
717	39	>75% Grass cover, Good, HSG A
1,237	96	Gravel surface, HSG A
10,418	98	Paved parking, HSG A
12,372	94	Weighted Average
1,954		15.79% Pervious Area
10,418		84.21% Impervious Area

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

Subcatchment S1-1: Drains to Parking Lot Chambers

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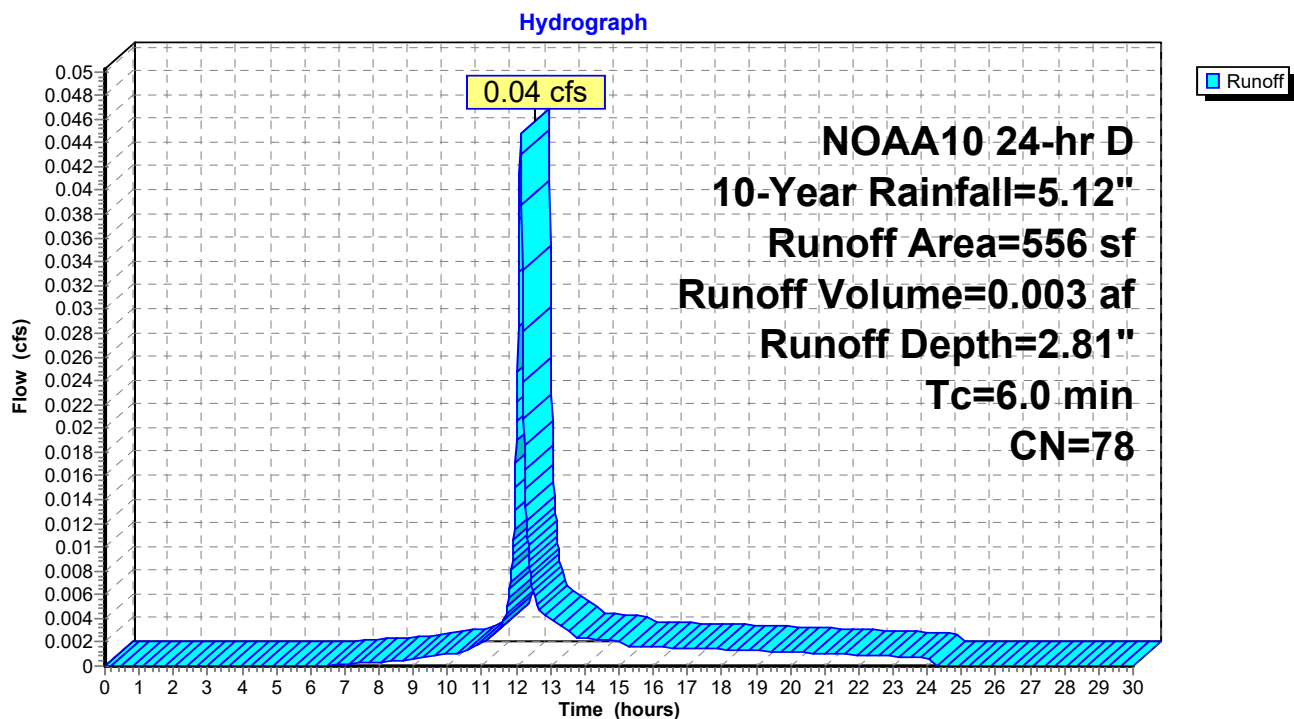
Summary for Subcatchment S1-2: Untreated Runoff onto Oakland St.

Runoff = 0.04 cfs @ 12.13 hrs, Volume= 0.003 af, Depth= 2.81"
Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
191	39	>75% Grass cover, Good, HSG A
365	98	Paved parking, HSG A
556	78	Weighted Average
191		34.35% Pervious Area
365		65.65% Impervious Area

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

Subcatchment S1-2: Untreated Runoff onto Oakland St.

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Summary for Subcatchment S2A: Easterly Roof & Lot Line

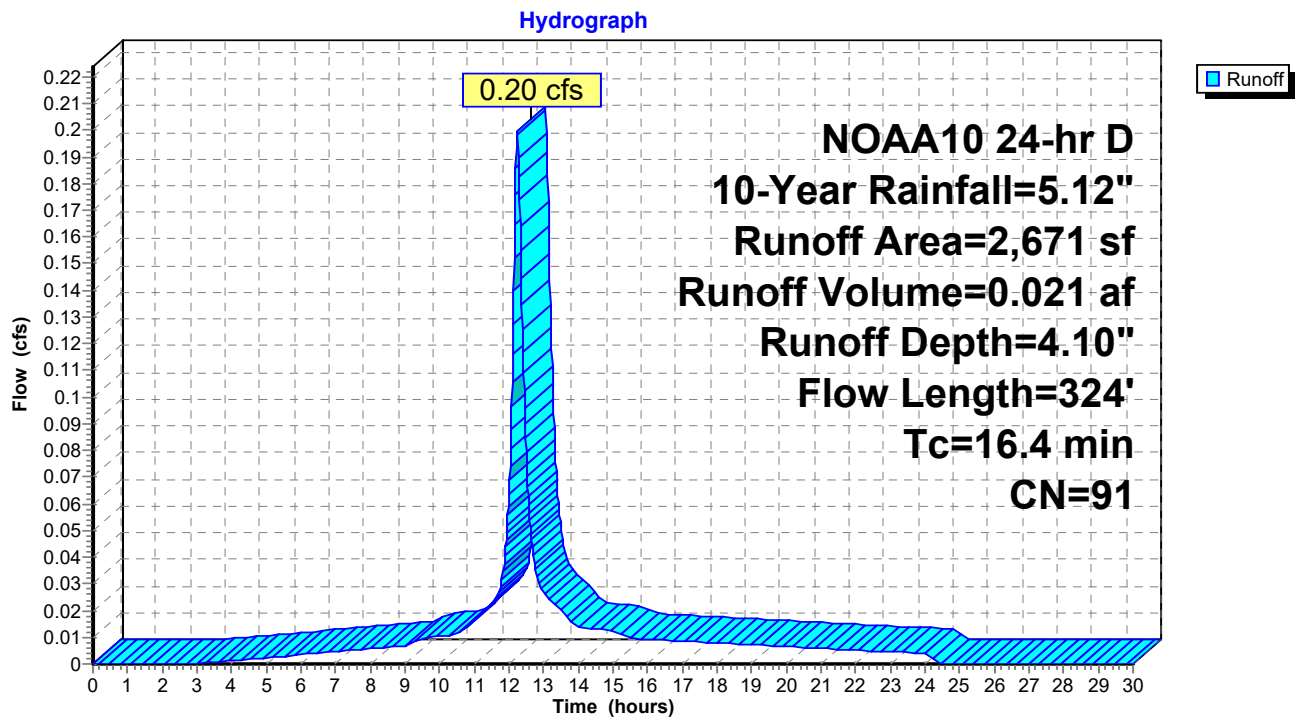
Runoff = 0.20 cfs @ 12.24 hrs, Volume= 0.021 af, Depth= 4.10"

Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
322	39	>75% Grass cover, Good, HSG A
2,349	98	Unconnected roofs, HSG A
2,671	91	Weighted Average
322		12.06% Pervious Area
2,349		87.94% Impervious Area
2,349		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A: Easterly Roof & Lot Line

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Summary for Subcatchment S2A-1: Easterly Lot Line

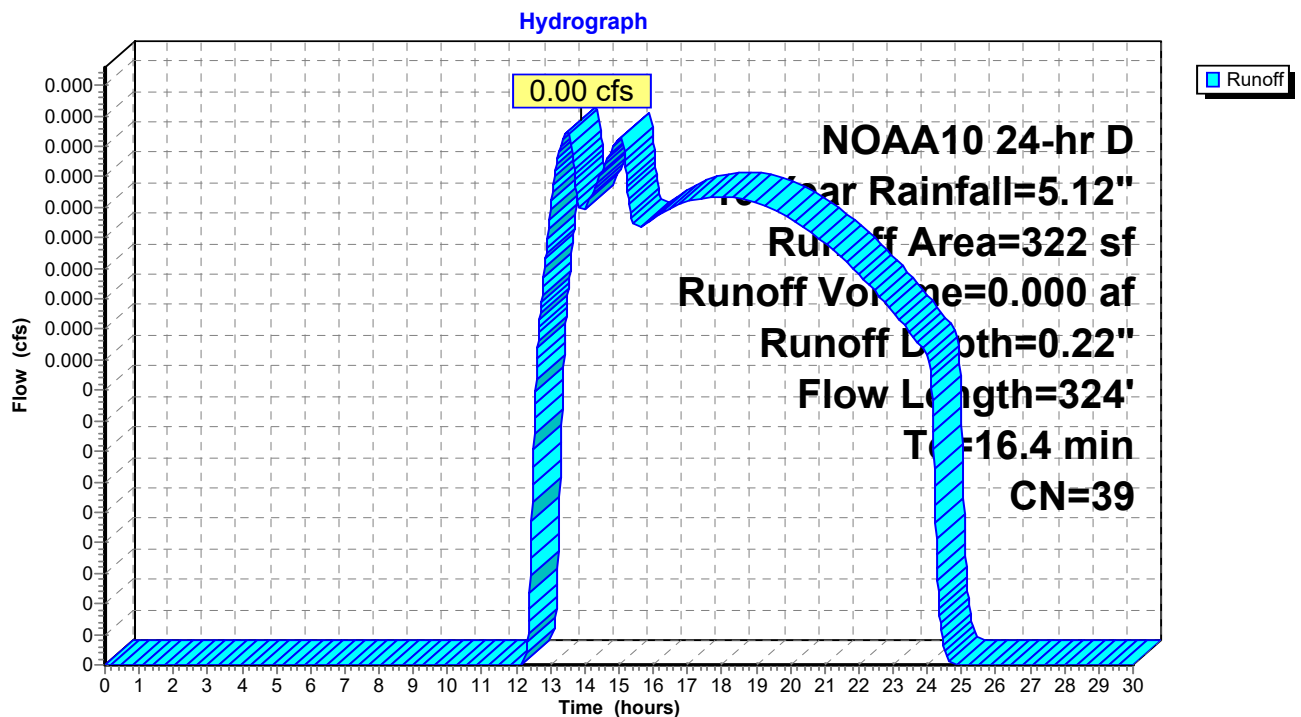
Runoff = 0.00 cfs @ 13.50 hrs, Volume= 0.000 af, Depth= 0.22"

Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
322	39	>75% Grass cover, Good, HSG A
322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A-1: Easterly Lot Line

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Summary for Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

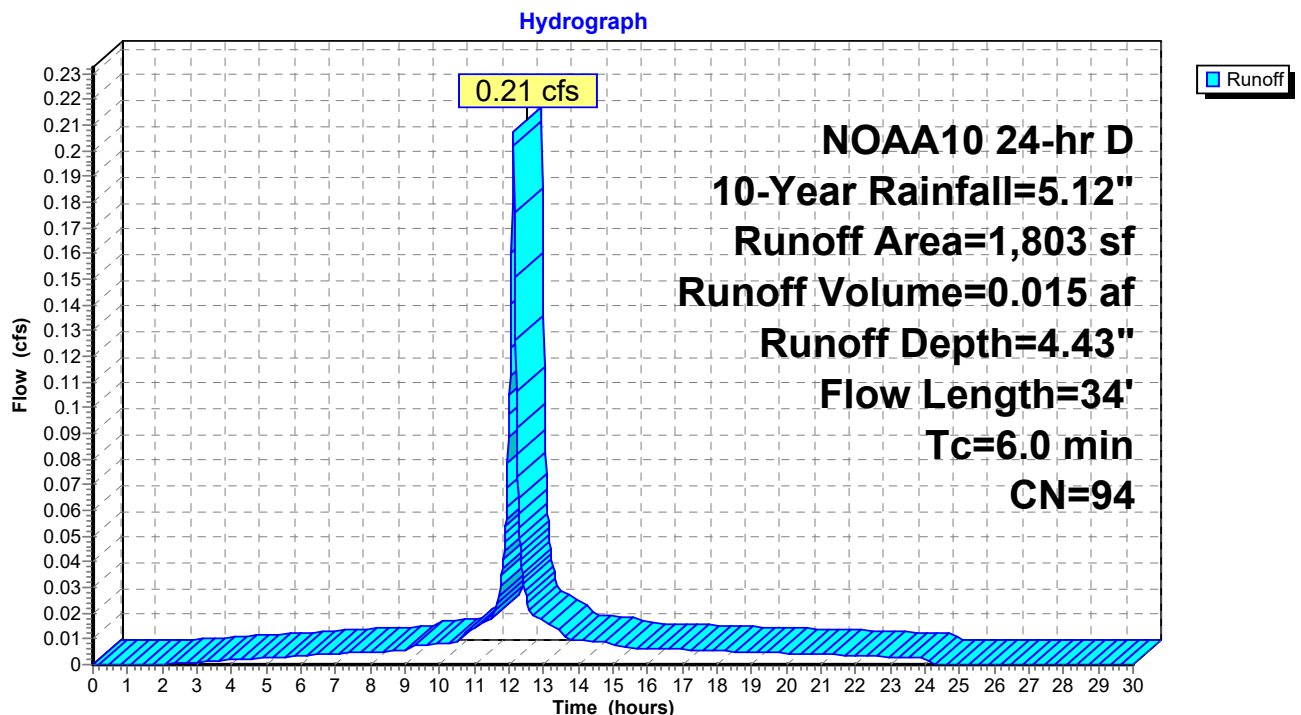
Runoff = 0.21 cfs @ 12.13 hrs, Volume= 0.015 af, Depth= 4.43"

Routed to Link L2 : Lag Time for Flow from S2B to DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
1,685	98	Unconnected roofs, HSG A
1,803	94	Weighted Average
118		6.54% Pervious Area
1,685		93.46% Impervious Area
1,685		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	34		0.09		Direct Entry, Assumed Minimum

Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

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Summary for Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214

Runoff = 0.00 cfs @ 15.01 hrs, Volume= 0.000 af, Depth= 0.22"

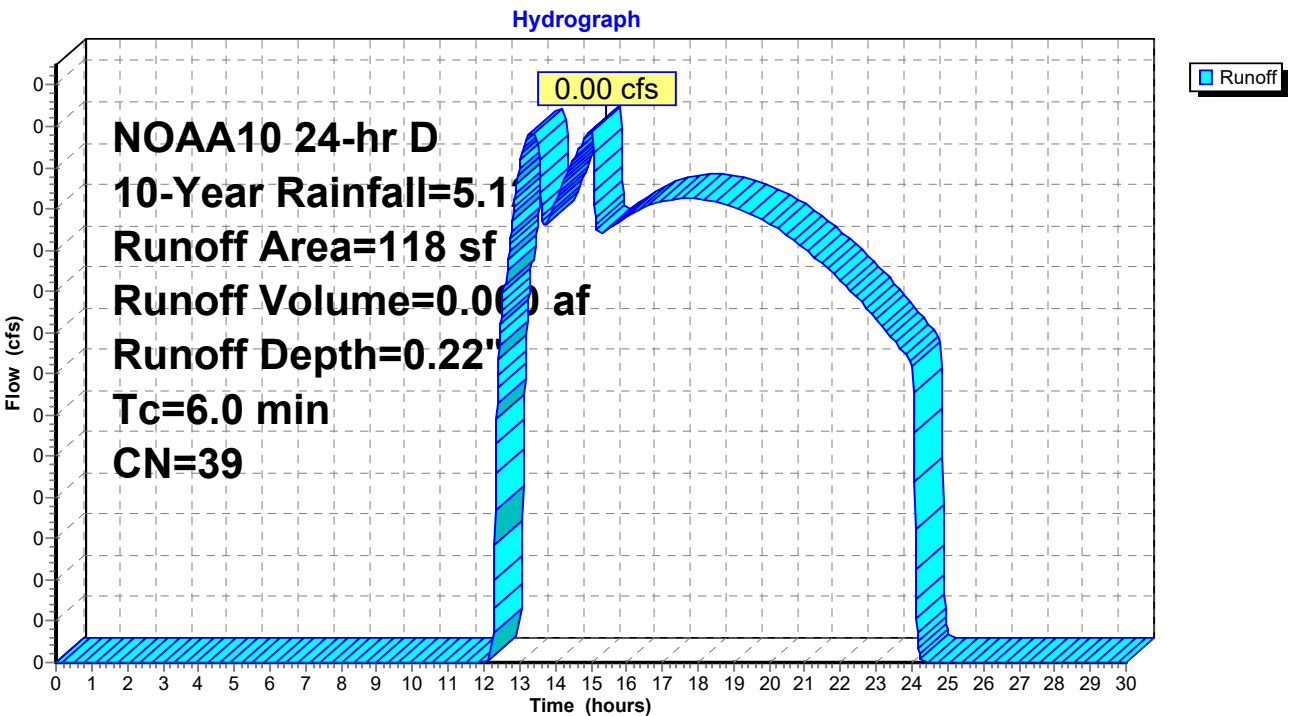
Routed to Link L2-1 : Lag Time for Flow from S2B-1 to DP2-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
118		100.00% Pervious Area

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

Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214



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NOAA10 24-hr D 10-Year Rainfall=5.12"

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Summary for Subcatchment S2C: Rear of Building & Site (SW)

Runoff = 0.11 cfs @ 12.19 hrs, Volume= 0.018 af, Depth= 0.53"

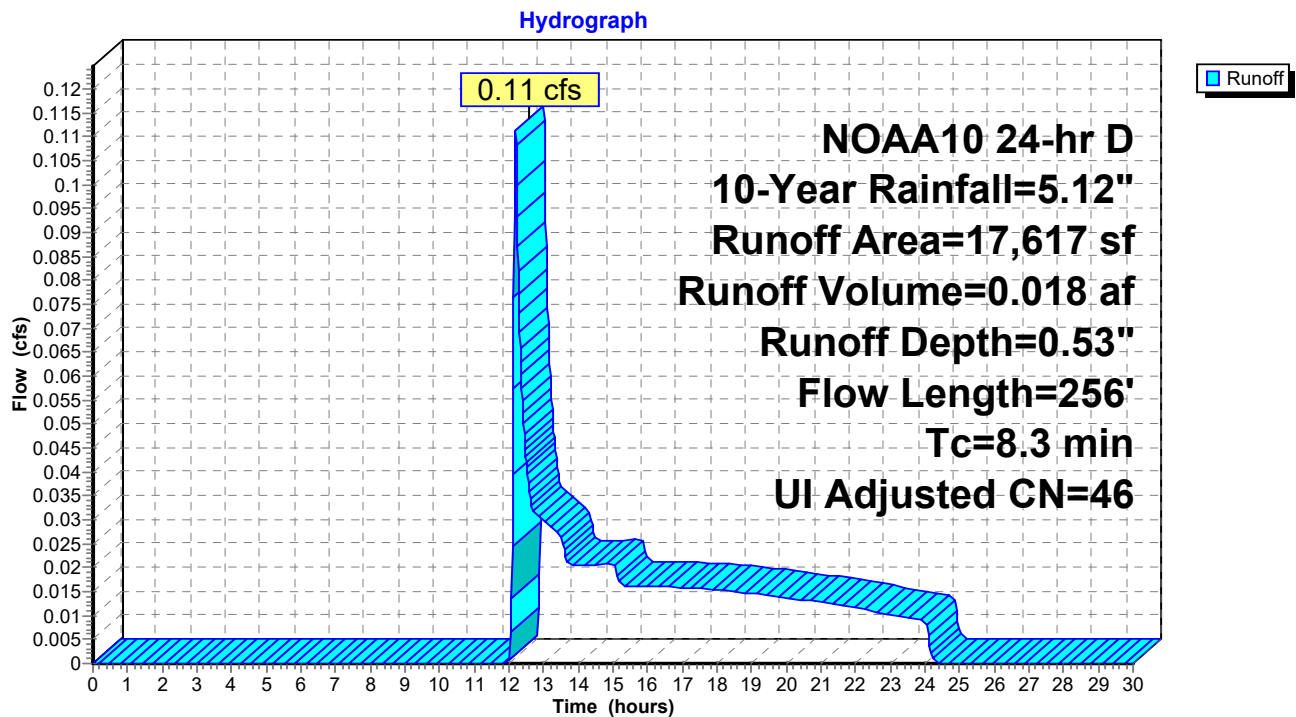
Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Adj	Description
1,157	39		>75% Grass cover, Good, HSG A
80	98		Paved parking, HSG A
4,226	98		Unconnected roofs, HSG A
2,147	77		Fallow, bare soil, HSG A
10,007	30		Woods, Good, HSG A
17,617	53	46	Weighted Average, UI Adjusted
13,311			75.56% Pervious Area
4,306			24.44% Impervious Area
4,226			98.14% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	53	0.4720	0.24		Sheet Flow, Wooded Slope Woods: Light underbrush n= 0.400 P2= 3.24"
4.5	177	0.0169	0.65		Shallow Concentrated Flow, Wooded Swale Woodland Kv= 5.0 fps
0.2	26	0.0169	1.95		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
8.3	256	Total			

Subcatchment S2C: Rear of Building & Site (SW)



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NOAA10 24-hr D 10-Year Rainfall=5.12"

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Summary for Subcatchment S2C-1: Perimeter of Garage

Runoff = 0.09 cfs @ 12.13 hrs, Volume= 0.006 af, Depth= 3.58"

Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

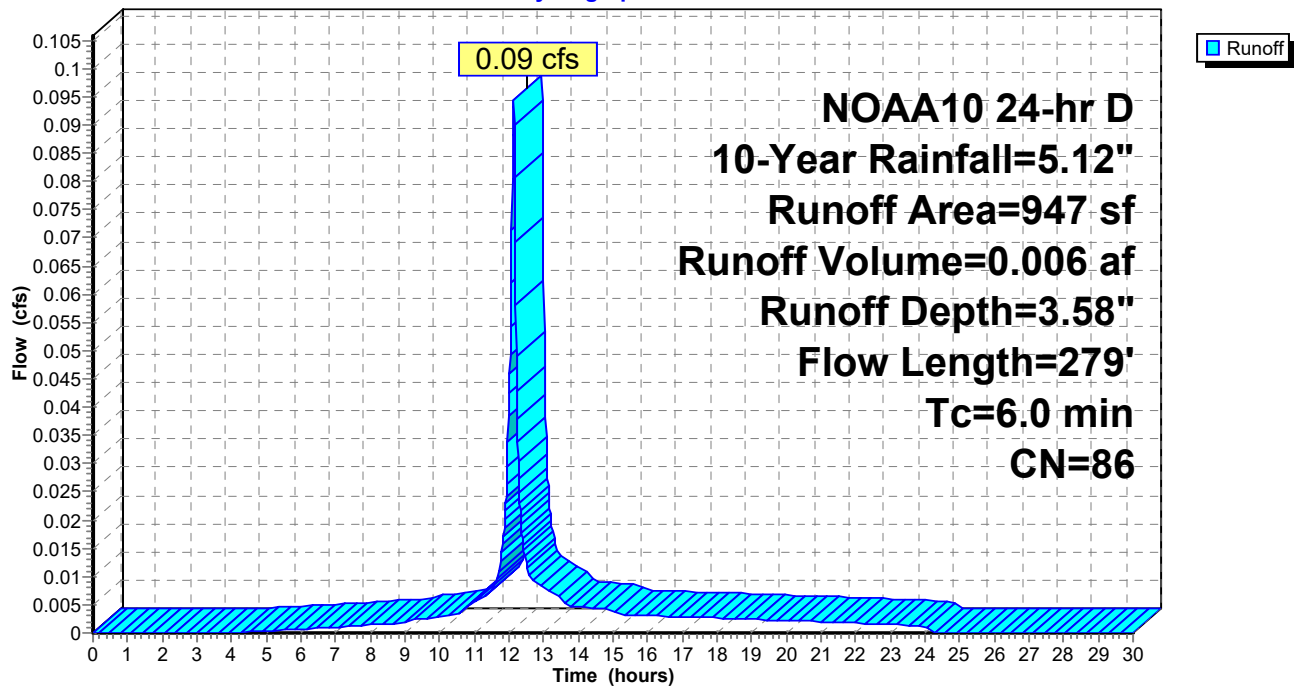
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
167	39	>75% Grass cover, Good, HSG A
780	96	Gravel surface, HSG A
947	86	Weighted Average
947		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	51	0.0451	0.21		Sheet Flow, Grassed Slope Grass: Short n= 0.150 P2= 3.24"
1.5	205	0.0195	2.25		Shallow Concentrated Flow, Stone Dust Walkway Unpaved Kv= 16.1 fps
0.3	23	0.0098	1.48		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
5.9	279	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S2C-1: Perimeter of Garage

Hydrograph



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NOAA10 24-hr D 10-Year Rainfall=5.12"

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Summary for Subcatchment S3: Corner of Oakland & Chestnut (NE)

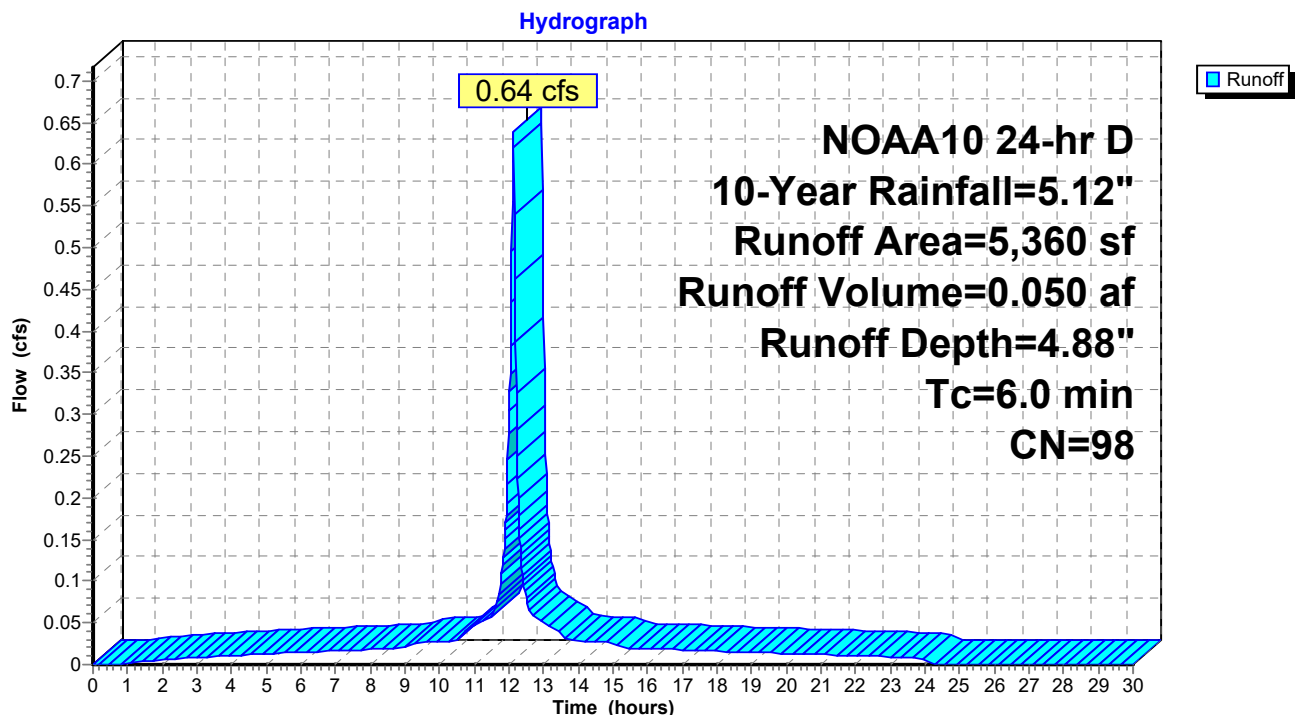
Runoff = 0.64 cfs @ 12.13 hrs, Volume= 0.050 af, Depth= 4.88"

Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
14	39	>75% Grass cover, Good, HSG A
1,053	98	Paved parking, HSG A
4,293	98	Roofs, HSG A
5,360	98	Weighted Average
14		0.26% Pervious Area
5,346		99.74% Impervious Area

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

Subcatchment S3: Corner of Oakland & Chestnut (NE)

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NOAA10 24-hr D 10-Year Rainfall=5.12"

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Summary for Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

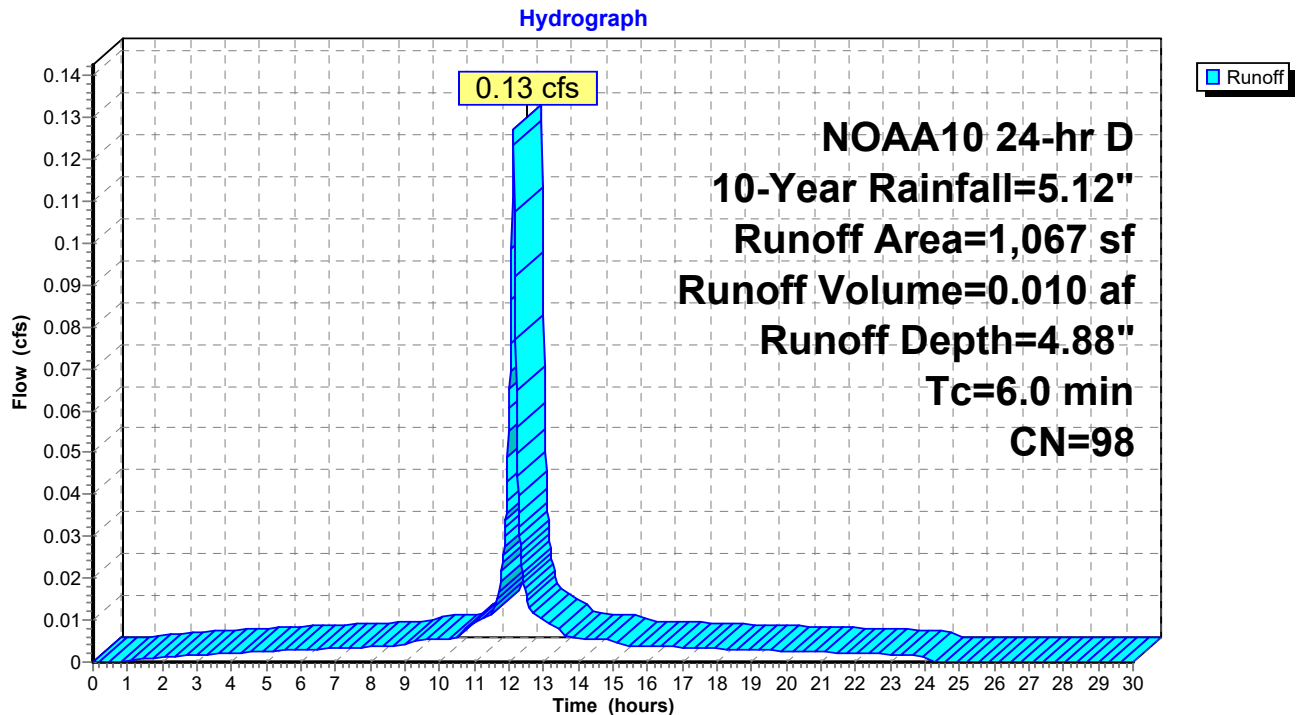
Runoff = 0.13 cfs @ 12.13 hrs, Volume= 0.010 af, Depth= 4.88"

Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
50	96	Gravel surface, HSG A
1,017	98	Paved parking, HSG A
1,067	98	Weighted Average
50		4.69% Pervious Area
1,017		95.31% Impervious Area

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

Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

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NOAA10 24-hr D 10-Year Rainfall=5.12"

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Summary for Subcatchment S4: Loading Dock

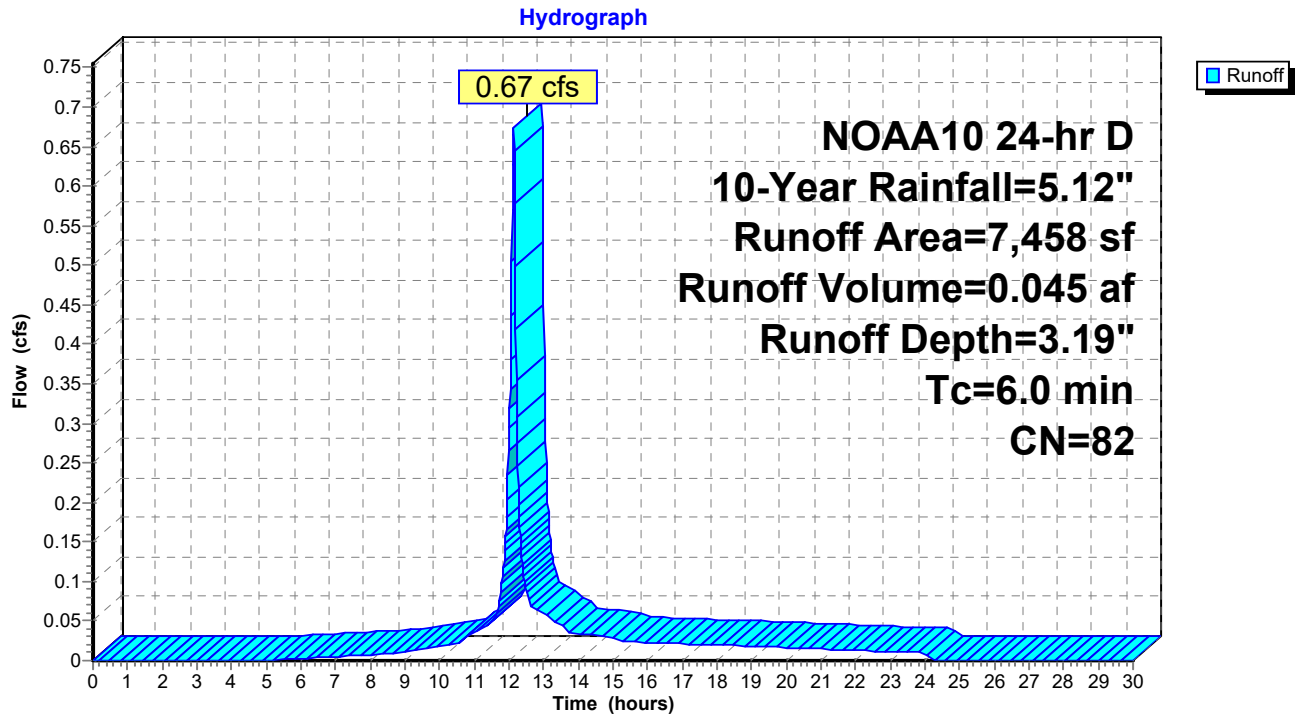
Runoff = 0.67 cfs @ 12.13 hrs, Volume= 0.045 af, Depth= 3.19"

Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
1,421	39	>75% Grass cover, Good, HSG A
2,055	98	Paved parking, HSG A
2,658	98	Roofs, HSG A
1,122	77	Fallow, bare soil, HSG A
202	30	Woods, Good, HSG A
7,458	82	Weighted Average
2,745		36.81% Pervious Area
4,713		63.19% Impervious Area

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

Subcatchment S4: Loading Dock

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Summary for Subcatchment S4-1: Garage Entrance

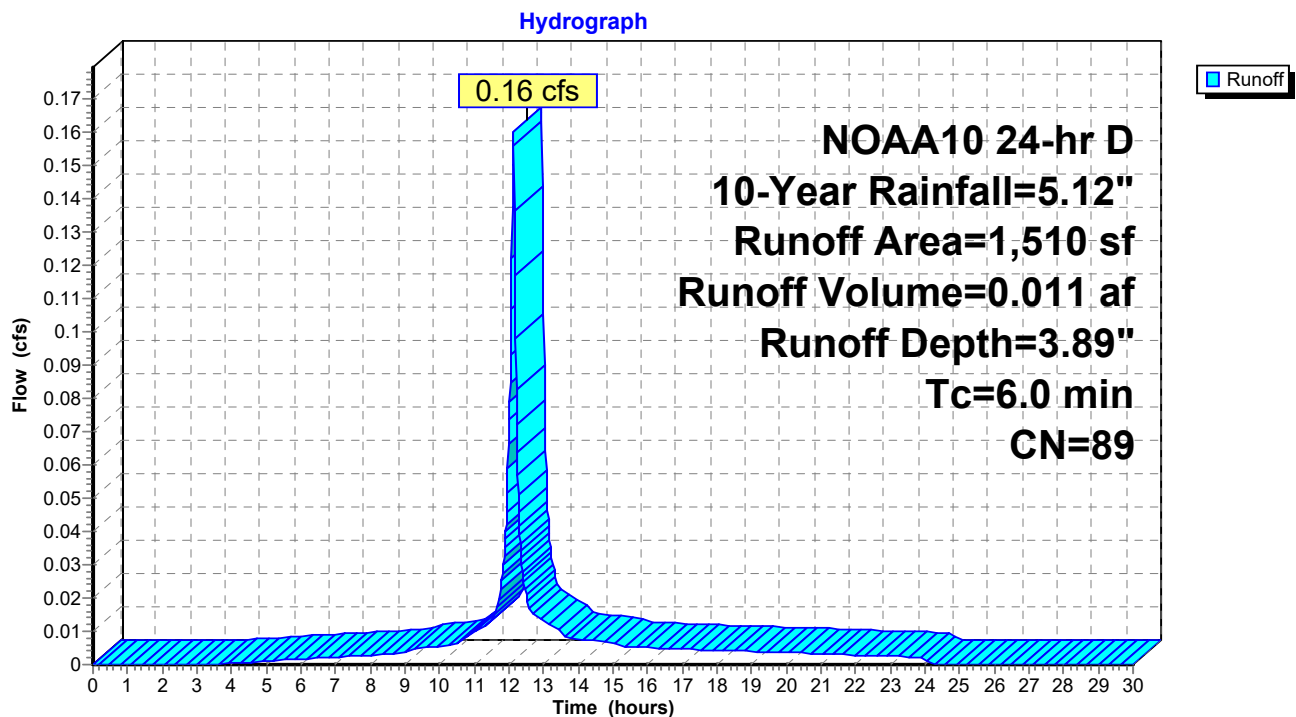
Runoff = 0.16 cfs @ 12.13 hrs, Volume= 0.011 af, Depth= 3.89"

Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
231	39	>75% Grass cover, Good, HSG A
323	96	Gravel surface, HSG A
956	98	Paved parking, HSG A
1,510	89	Weighted Average
554		36.69% Pervious Area
956		63.31% Impervious Area

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

Subcatchment S4-1: Garage Entrance

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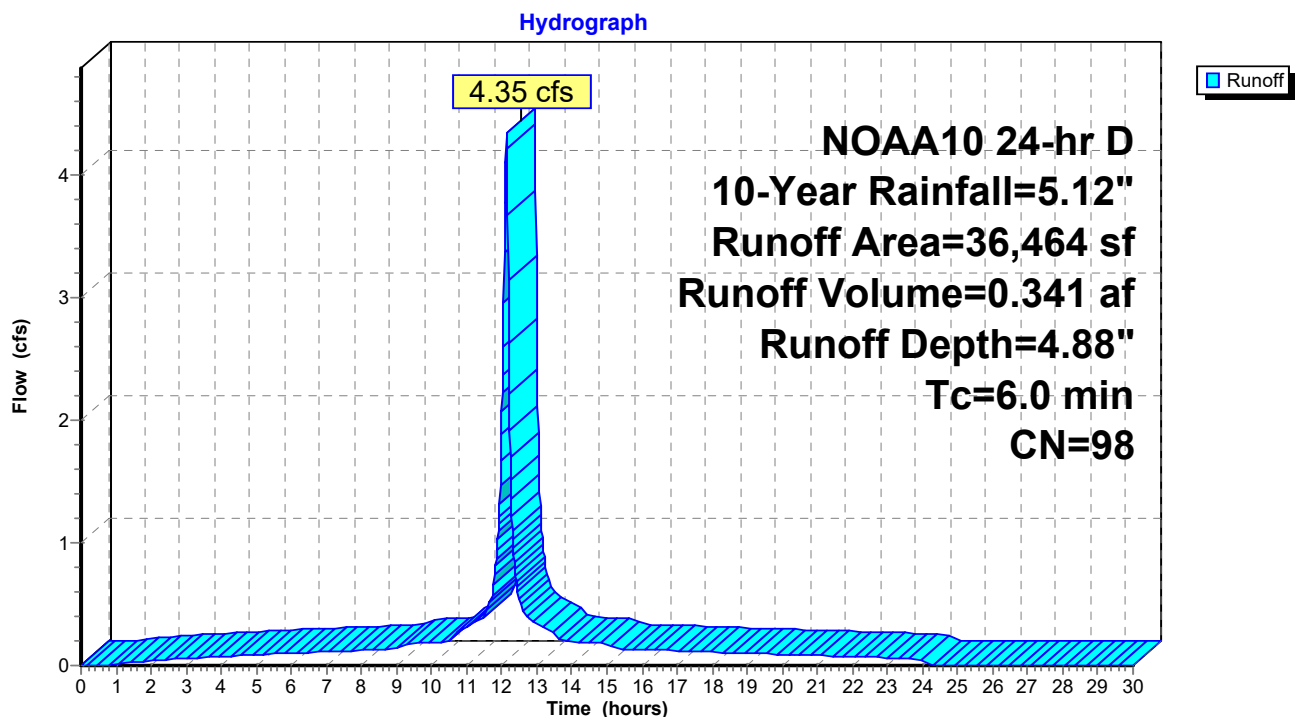
Summary for Subcatchment S4-2: Proposed Roofs

Runoff = 4.35 cfs @ 12.13 hrs, Volume= 0.341 af, Depth= 4.88"
Routed to Pond DC1 : Detention Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
36,464	98	Roofs, HSG A
36,464		100.00% Impervious Area

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

Subcatchment S4-2: Proposed Roofs

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NOAA10 24-hr D 10-Year Rainfall=5.12"

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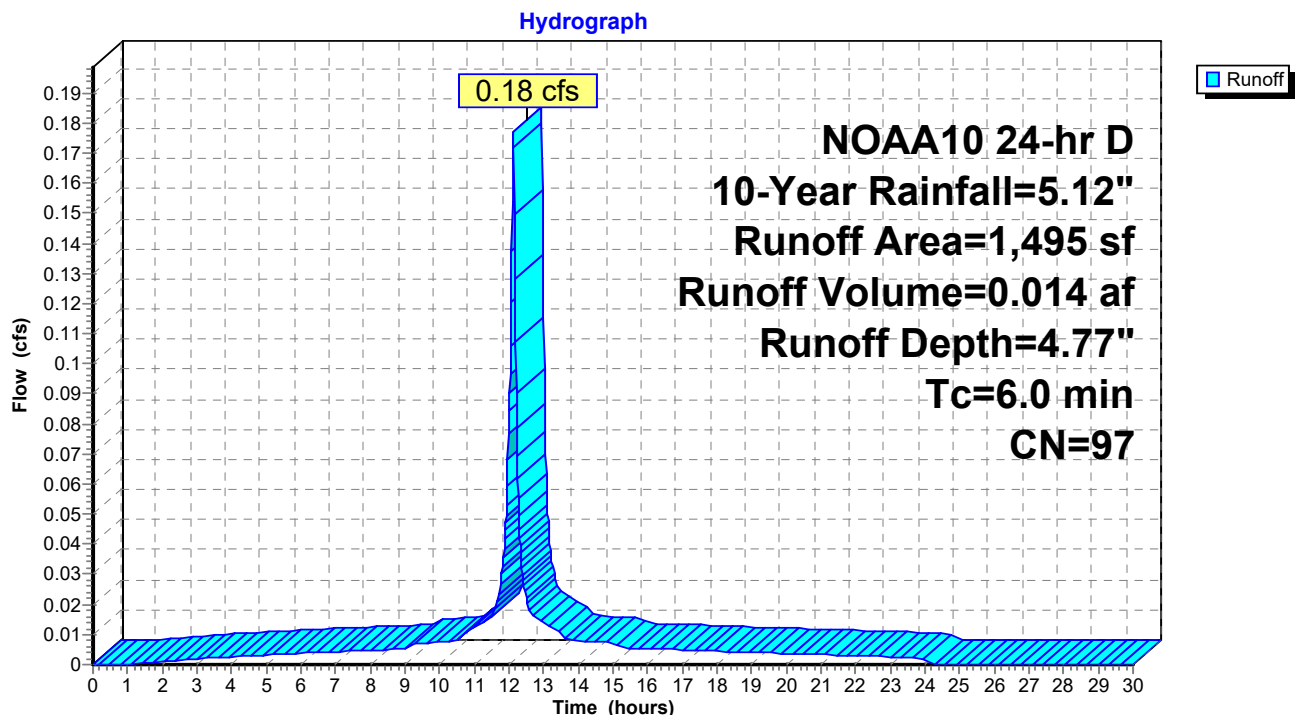
Summary for Subcatchment S4-3: Gap Between Buildings

Runoff = 0.18 cfs @ 12.13 hrs, Volume= 0.014 af, Depth= 4.77"
Routed to Pond GAP : Area Drain

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Area (sf)	CN	Description
559	96	Gravel surface, HSG A
936	98	Unconnected roofs, HSG A
1,495	97	Weighted Average
559		37.39% Pervious Area
936		62.61% Impervious Area
936		100.00% Unconnected

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

Subcatchment S4-3: Gap Between Buildings

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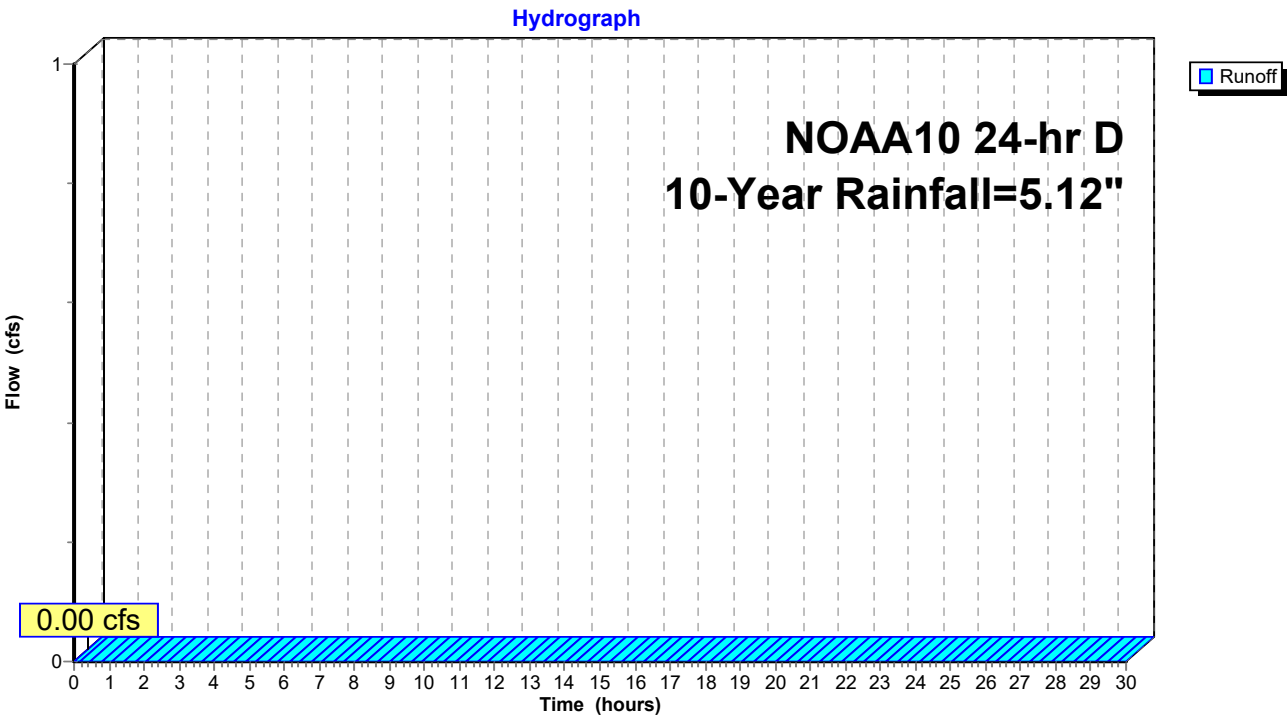
Summary for Subcatchment Tc: Extra Tc Calc's

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 10-Year Rainfall=5.12"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	70	0.0501	5.28	4.15	Pipe Channel, CB 2 to DMH 1 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.1	33	0.1391	8.80	6.91	Pipe Channel, DMH 1 to DMH 2 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.3	139	0.0701	9.18	7.21	Pipe Channel, DMH 2 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
6.3	55	0.0182	0.15		Sheet Flow, Lawn (L2 to DP2) Grass: Short n= 0.150 P2= 3.24"
0.3	27	0.0079	1.33		Shallow Concentrated Flow, Lawn (DP2 to CB 8) Grassed Waterway Kv= 15.0 fps
0.4	47	0.0079	1.80		Shallow Concentrated Flow, Chestnut St. Gutter (DP2 to CB 8) Paved Kv= 20.3 fps
0.0	9	0.0811	9.88	7.76	Pipe Channel, CB 8 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
0.4	143	0.0222	6.77	11.97	Pipe Channel, DMH 3 to DMH 4 18.00" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.017 Concrete sewer w/manholes & inlets
8.0	523	Total			

Subcatchment Tc: Extra Tc Calc's



Summary for Pond CDS1: Water Quality Catch Basin

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 4.43" for 10-Year event
 Inflow = 1.42 cfs @ 12.13 hrs, Volume= 0.105 af
 Outflow = 1.42 cfs @ 12.13 hrs, Volume= 0.105 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.42 cfs @ 12.13 hrs, Volume= 0.105 af
 Routed to Pond IC2 : Infiltration Chamber Under Parking Lot

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 51.74' @ 12.13 hrs

Flood Elev= 52.00'

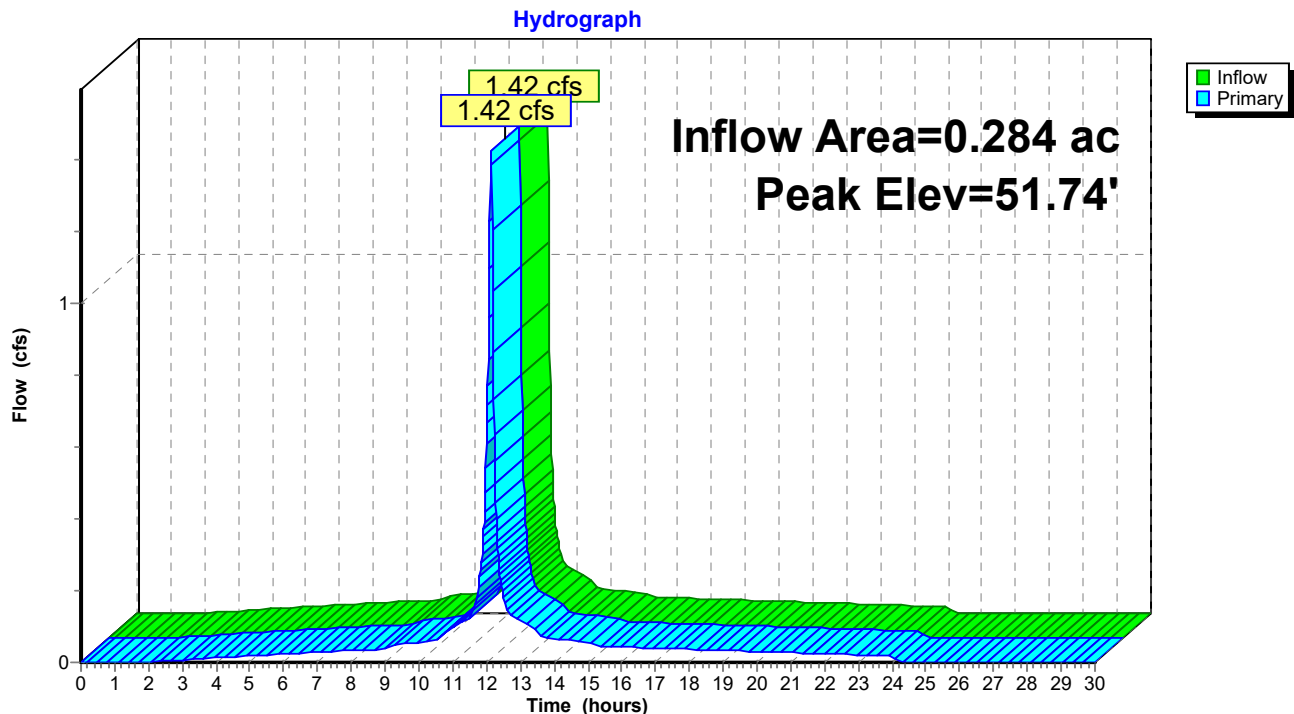
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 ' S= 0.0089 ' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=1.41 cfs @ 12.13 hrs HW=51.74' TW=50.05' (Dynamic Tailwater)

1=RCP Culvert (SD-3) (Passes 1.41 cfs of 4.91 cfs potential flow)

2=Neenah R1878-A6G Grate (Weir Controls 1.41 cfs @ 1.21 fps)

Pond CDS1: Water Quality Catch Basin



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Summary for Pond DC1: Detention Chamber

Inflow Area = 0.871 ac, 98.53% Impervious, Inflow Depth = 4.88" for 10-Year event
 Inflow = 4.53 cfs @ 12.13 hrs, Volume= 0.354 af
 Outflow = 2.26 cfs @ 12.21 hrs, Volume= 0.354 af, Atten= 50%, Lag= 5.1 min
 Primary = 2.26 cfs @ 12.21 hrs, Volume= 0.354 af
 Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 26.38' @ 12.21 hrs Surf.Area= 543 sf Storage= 1,834 cf

Plug-Flow detention time= 14.3 min calculated for 0.354 af (100% of inflow)
 Center-of-Mass det. time= 14.2 min (764.7 - 750.5)

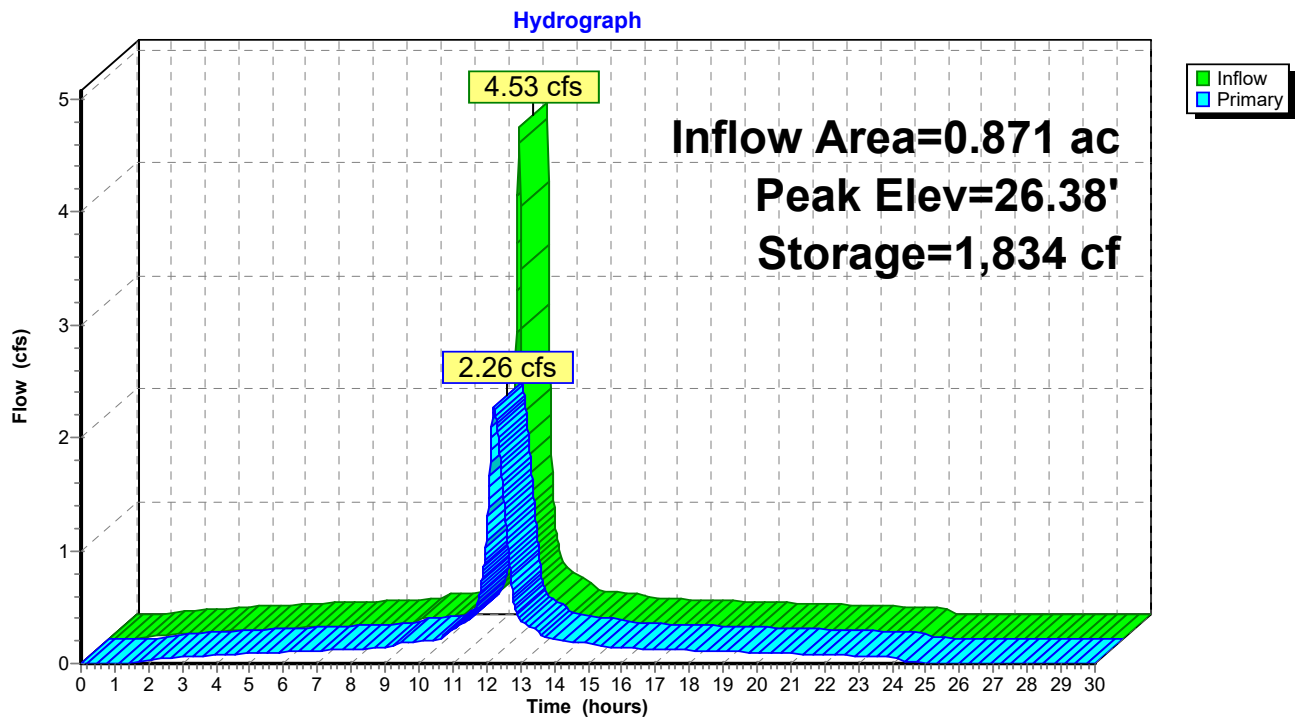
Volume	Invert	Avail.Storage	Storage Description
#1	23.01'	3,217 cf	8.67'W x 15.67'L x 5.92'H Shea Fire Cistern Bankx 4

Device	Routing	Invert	Outlet Devices
#1	Primary	23.01'	12.00" Round RCP Culvert (SD-1) L= 69.4' Ke= 1.800 Inlet / Outlet Invert= 23.01' / 22.66' S= 0.0050 '/ Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	23.01'	7.00" Vert. Control Orifice (2-yr & 10-yr) C= 0.600 Limited to weir flow at low heads
#3	Device 1	27.25'	4.00" Vert. Control Orifice (25-yr) X 4.00 C= 0.600 Limited to weir flow at low heads
#4	Device 1	28.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Primary OutFlow Max=2.26 cfs @ 12.21 hrs HW=26.38' TW=0.00' (Dynamic Tailwater)

- 1=RCP Culvert (SD-1) (Passes 2.26 cfs of 3.43 cfs potential flow)
- 2=Control Orifice (2-yr & 10-yr) (Orifice Controls 2.26 cfs @ 8.45 fps)
- 3=Control Orifice (25-yr) (Controls 0.00 cfs)
- 4=Overflow Orifice (Controls 0.00 cfs)

Pond DC1: Detention Chamber



Summary for Pond DSCB-1: Deep Sump Catch Basin

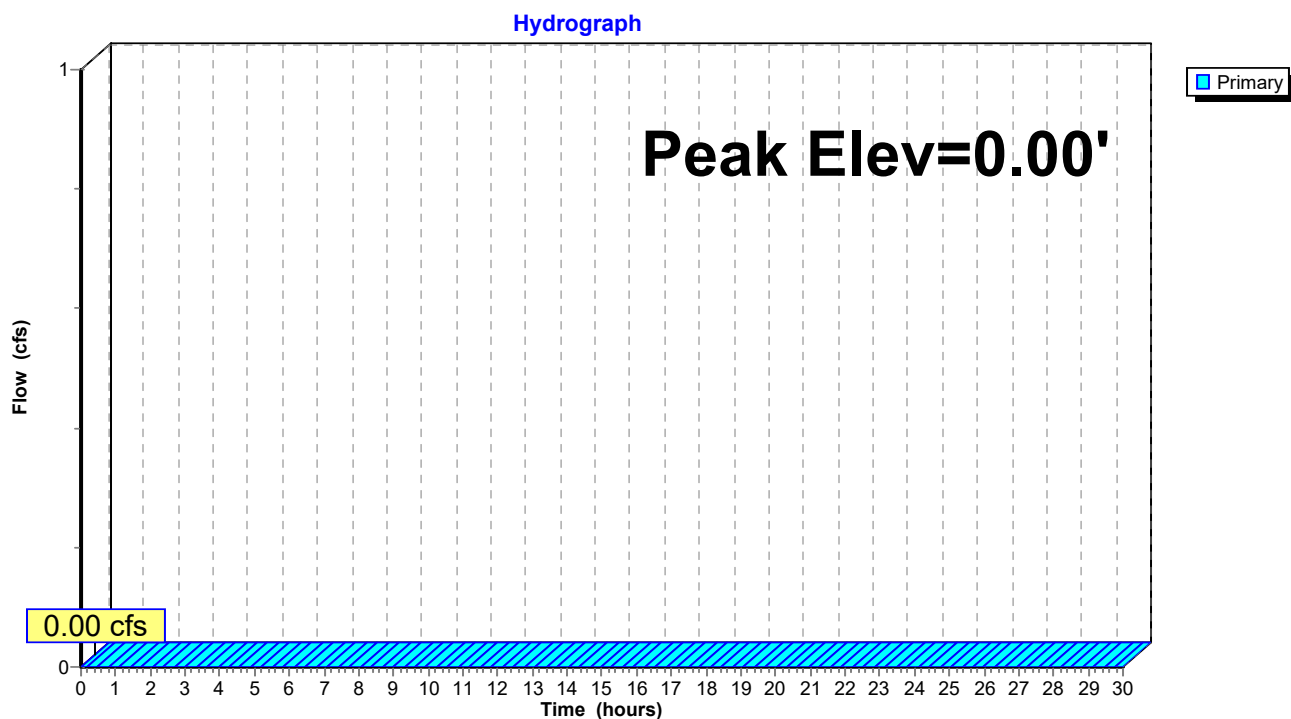
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round Hooded RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 1' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

1=Hooded RCP Culvert (SD-3) (Controls 0.00 cfs)

2=Neenah R1878-A6G Grate (Controls 0.00 cfs)

Pond DSCB-1: Deep Sump Catch Basin



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Summary for Pond GAP: Area Drain

Inflow Area = 0.034 ac, 62.61% Impervious, Inflow Depth = 4.77" for 10-Year event
 Inflow = 0.18 cfs @ 12.13 hrs, Volume= 0.014 af
 Outflow = 0.18 cfs @ 12.13 hrs, Volume= 0.014 af, Atten= 0%, Lag= 0.1 min
 Primary = 0.18 cfs @ 12.13 hrs, Volume= 0.014 af
 Routed to Pond DC1 : Detention Chamber

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 54.50' @ 12.13 hrs Storage= 0 cf

Flood Elev= 55.00' Storage= 112 cf

Plug-Flow detention time= 0.0 min calculated for 0.014 af (100% of inflow)

Center-of-Mass det. time= 0.0 min (759.4 - 759.3)

Volume	Invert	Avail.Storage	Storage Description	
#1	54.50'	2,068 cf	Open Area (Prismatic) Listed below -Impervious	
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.50	559	0.0	0	0
55.00	559	40.0	112	112
58.50	559	100.0	1,957	2,068

Device	Routing	Invert	Outlet Devices
#1	Primary	26.00'	6.00" Round Ductile Iron Drain Pipe (SD-4) L= 27.6' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.00' / 25.00' S= 0.0362 ' / ' Cc= 0.900 n= 0.014 Steel, smooth, Flow Area= 0.20 sf
#2	Device 1	54.50'	2.00" x 2.00" Horiz. Neenah R-3203-A Inlet Grate X 6.00 columns X 6 rows C= 0.600 in 20.00" x 20.00" Grate (36% open area)

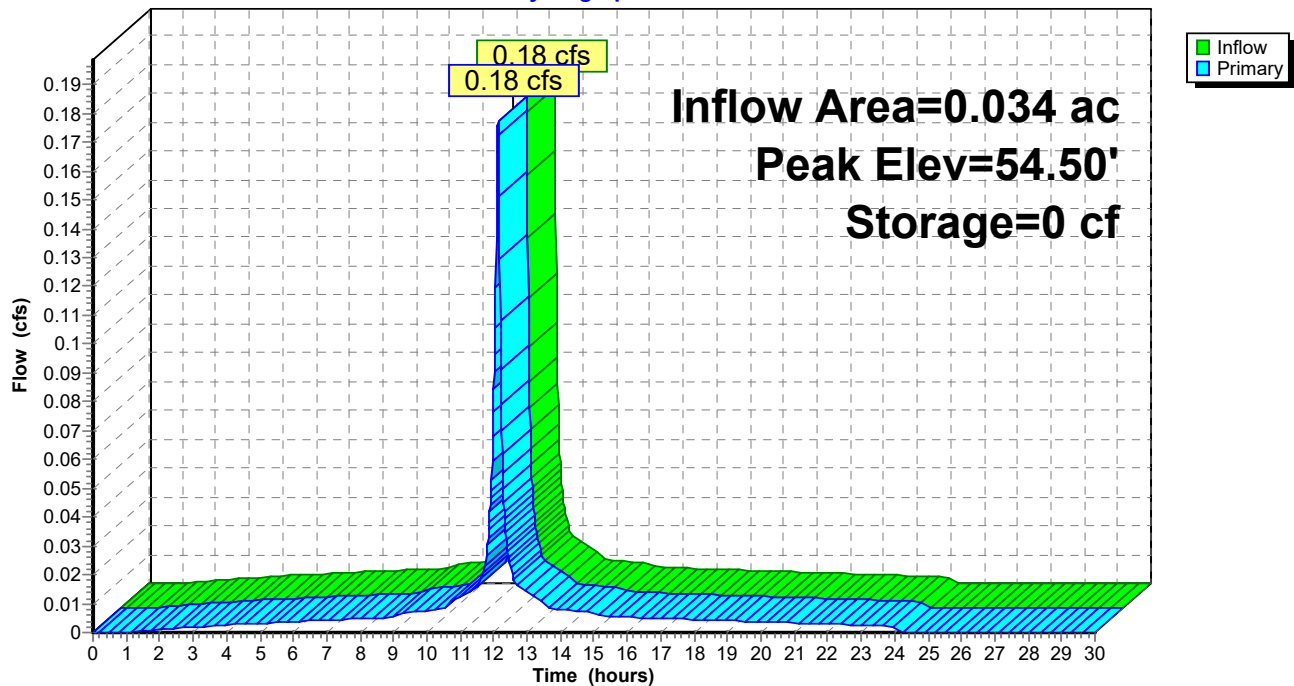
Primary OutFlow Max=0.18 cfs @ 12.13 hrs HW=54.50' TW=25.63' (Dynamic Tailwater)

1=Ductile Iron Drain Pipe (SD-4) (Passes 0.18 cfs of 4.22 cfs potential flow)

2=Neenah R-3203-A Inlet Grate (Orifice Controls 0.18 cfs @ 0.18 fps)

Pond GAP: Area Drain

Hydrograph



Summary for Pond IC1: Infiltration Chamber Under Garage

Volume	Invert	Avail.Storage	Storage Description
#1A	22.73'	450 cf	50.00'W x 16.00'L x 6.17'H Field A 4,936 cf Overall - 3,810 cf Embedded = 1,126 cf x 40.0% Voids
#2A	23.23'	3,000 cf	Shea Leaching Chamber 8x14x5.7 x 6 Inside #1 Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf 6 Chambers in 6 Rows
		3,450 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.73'	25.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 15.00' Phase-In= 0.08'
#2	Primary	24.55'	12.00" Round RCP Culvert (SD-1) L= 70.7' Ke= 1.800 Inlet / Outlet Invert= 24.55' / 24.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	24.55'	4.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	27.60'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

↑ **1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

↑ **2=RCP Culvert (SD-1)** (Controls 0.00 cfs)

↑ **3=Control Orifice** (Controls 0.00 cfs)

↑ **4=Overflow Orifice** (Controls 0.00 cfs)

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Pond IC1: Infiltration Chamber Under Garage - Chamber Wizard Field A

Chamber Model = Shea Leaching Chamber 8x14x5.7 (Shea Galley)

Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf

Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf

1 Chambers/Row x 14.00' Long = 14.00' Row Length +12.0" End Stone x 2 = 16.00' Base Length

6 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 50.00' Base Width

6.0" Stone Base + 68.0" Chamber Height = 6.17' Field Height

6 Chambers x 500.0 cf = 3,000.0 cf Chamber Storage

6 Chambers x 635.0 cf = 3,810.2 cf Displacement

4,936.0 cf Field - 3,810.2 cf Chambers = 1,125.8 cf Stone x 40.0% Voids = 450.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,450.3 cf = 0.079 af

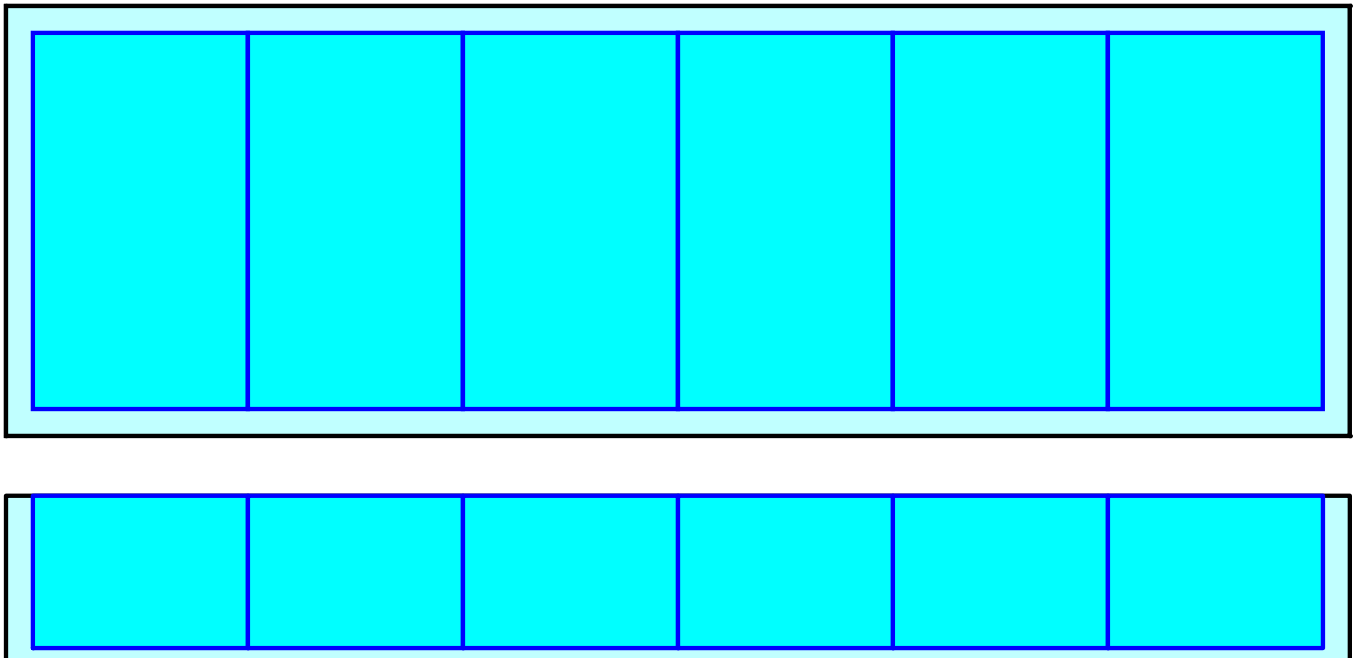
Overall Storage Efficiency = 69.9%

Overall System Size = 16.00' x 50.00' x 6.17'

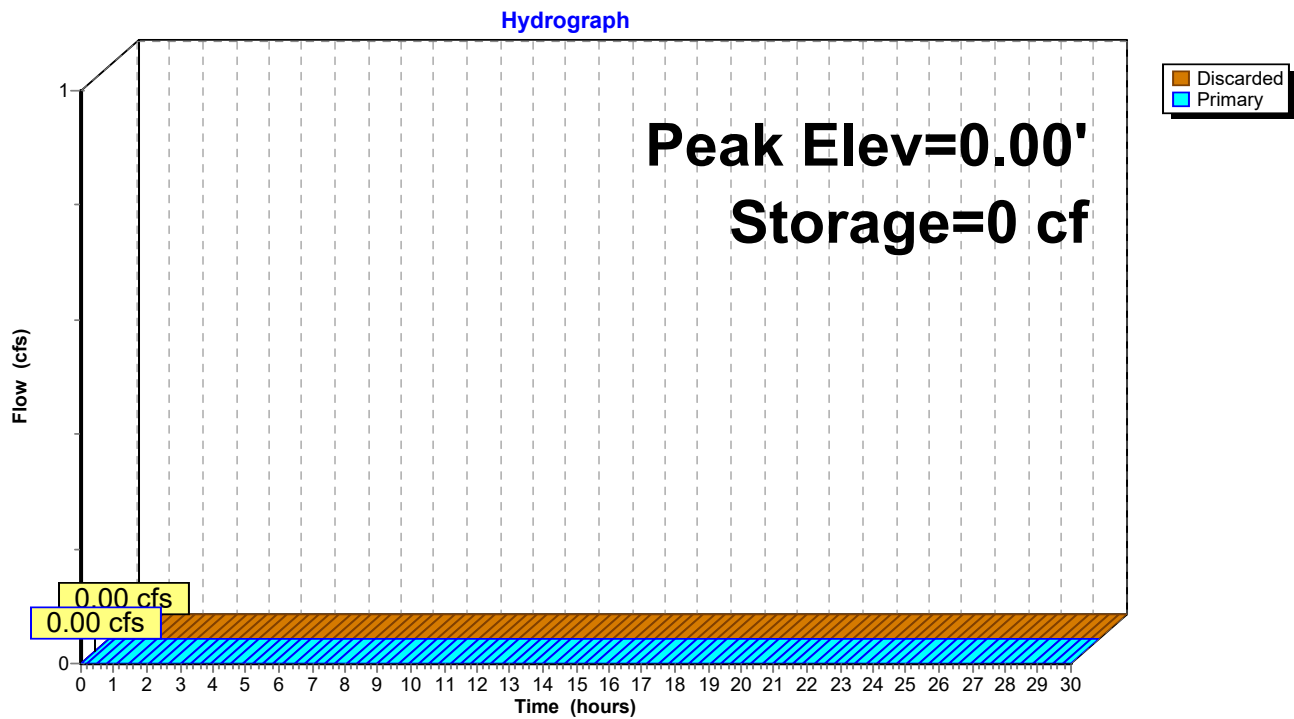
6 Chambers

182.8 cy Field

41.7 cy Stone



Pond IC1: Infiltration Chamber Under Garage



Summary for Pond IC2: Infiltration Chamber Under Parking Lot

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 4.43" for 10-Year event
 Inflow = 1.42 cfs @ 12.13 hrs, Volume= 0.105 af
 Outflow = 1.16 cfs @ 12.17 hrs, Volume= 0.105 af, Atten= 18%, Lag= 2.4 min
 Discarded = 0.07 cfs @ 12.17 hrs, Volume= 0.075 af
 Primary = 1.09 cfs @ 12.17 hrs, Volume= 0.030 af
 Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 50.13' @ 12.17 hrs Surf.Area= 540 sf Storage= 783 cf

Plug-Flow detention time= 42.6 min calculated for 0.105 af (100% of inflow)
 Center-of-Mass det. time= 42.6 min (824.1 - 781.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	48.08'	206 cf	18.00'W x 30.00'L x 3.17'H Field A 1,712 cf Overall - 1,196 cf Embedded = 516 cf x 40.0% Voids
#2A	48.58'	800 cf	Shea Leaching Chamber 8x14x2.7 x 4 Inside #1 Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf 4 Chambers in 2 Rows
		1,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.08'	4.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 17.50' Phase-In= 0.08'
#2	Primary	49.33'	12.00" Round RCP Culvert (SD-2) L= 53.0' Ke= 1.800 Inlet / Outlet Invert= 49.33' / 48.00' S= 0.0251 ' /' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	49.33'	9.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	50.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.17 hrs HW=50.12' (Free Discharge)
 ↳ **1=Exfiltration** (Controls 0.07 cfs)

Primary OutFlow Max=1.09 cfs @ 12.17 hrs HW=50.12' TW=0.00' (Dynamic Tailwater)
 ↳ **2=RCP Culvert (SD-2)** (Inlet Controls 1.09 cfs @ 1.62 fps)
 ↳ **3=Control Orifice** (Passes 1.09 cfs of 1.38 cfs potential flow)
 ↳ **4=Overflow Orifice** (Controls 0.00 cfs)

Pond IC2: Infiltration Chamber Under Parking Lot - Chamber Wizard Field A**Chamber Model = Shea Leaching Chamber 8x14x2.7 (Shea Galley)**

Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf

Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf

2 Chambers/Row x 14.00' Long = 28.00' Row Length +12.0" End Stone x 2 = 30.00' Base Length

2 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 18.00' Base Width

6.0" Stone Base + 32.0" Chamber Height = 3.17' Field Height

4 Chambers x 200.0 cf = 800.0 cf Chamber Storage

4 Chambers x 299.0 cf = 1,196.2 cf Displacement

1,711.8 cf Field - 1,196.2 cf Chambers = 515.6 cf Stone x 40.0% Voids = 206.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,006.3 cf = 0.023 af

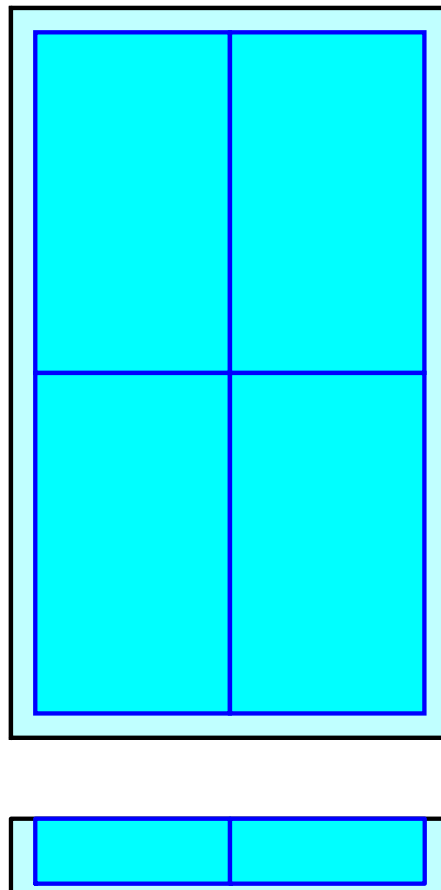
Overall Storage Efficiency = 58.8%

Overall System Size = 30.00' x 18.00' x 3.17'

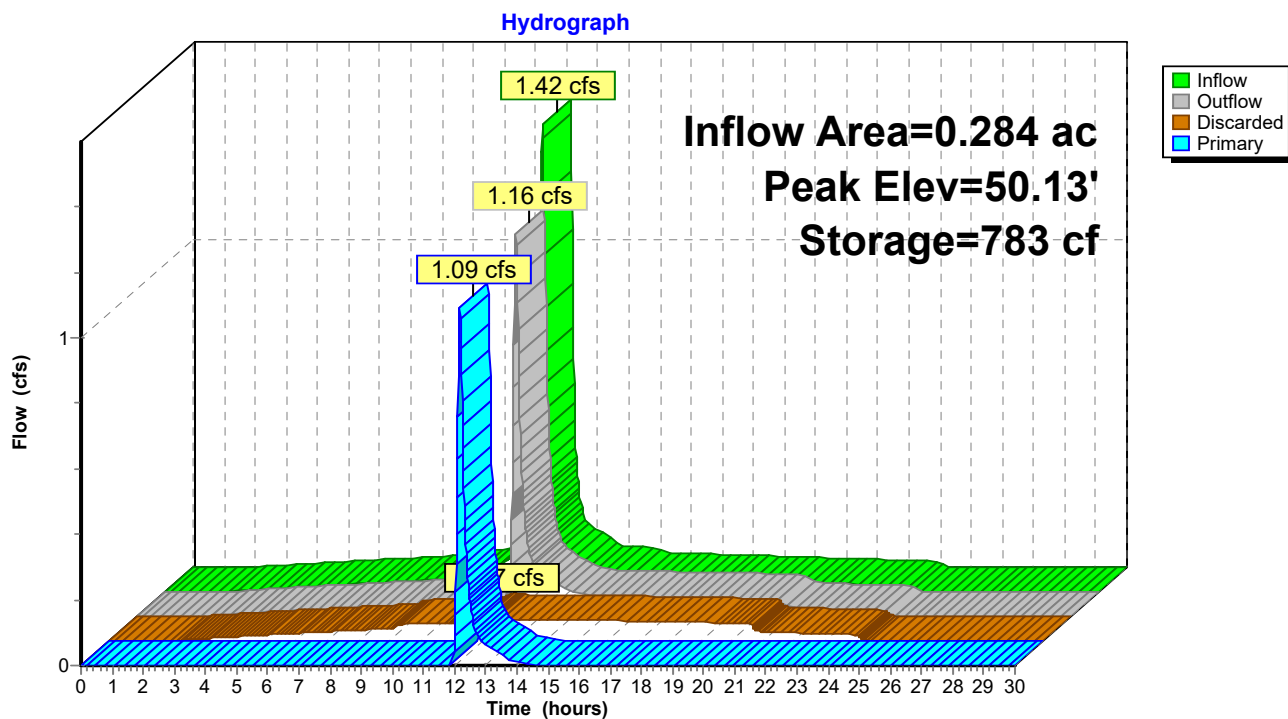
4 Chambers

63.4 cy Field

19.1 cy Stone



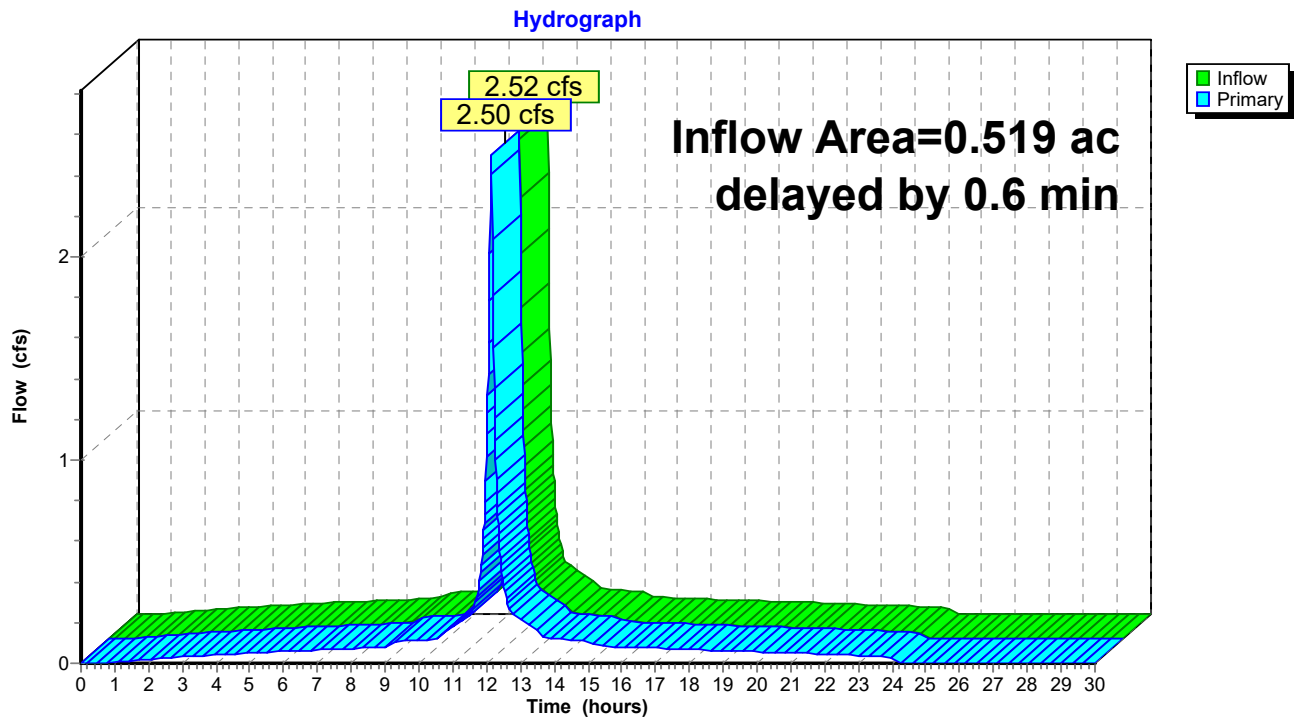
Pond IC2: Infiltration Chamber Under Parking Lot



Summary for Link DP1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.519 ac, 98.58% Impervious, Inflow Depth = 4.79" for 10-Year event
Inflow = 2.52 cfs @ 12.13 hrs, Volume= 0.207 af
Primary = 2.50 cfs @ 12.14 hrs, Volume= 0.207 af, Atten= 1%, Lag= 0.6 min
Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

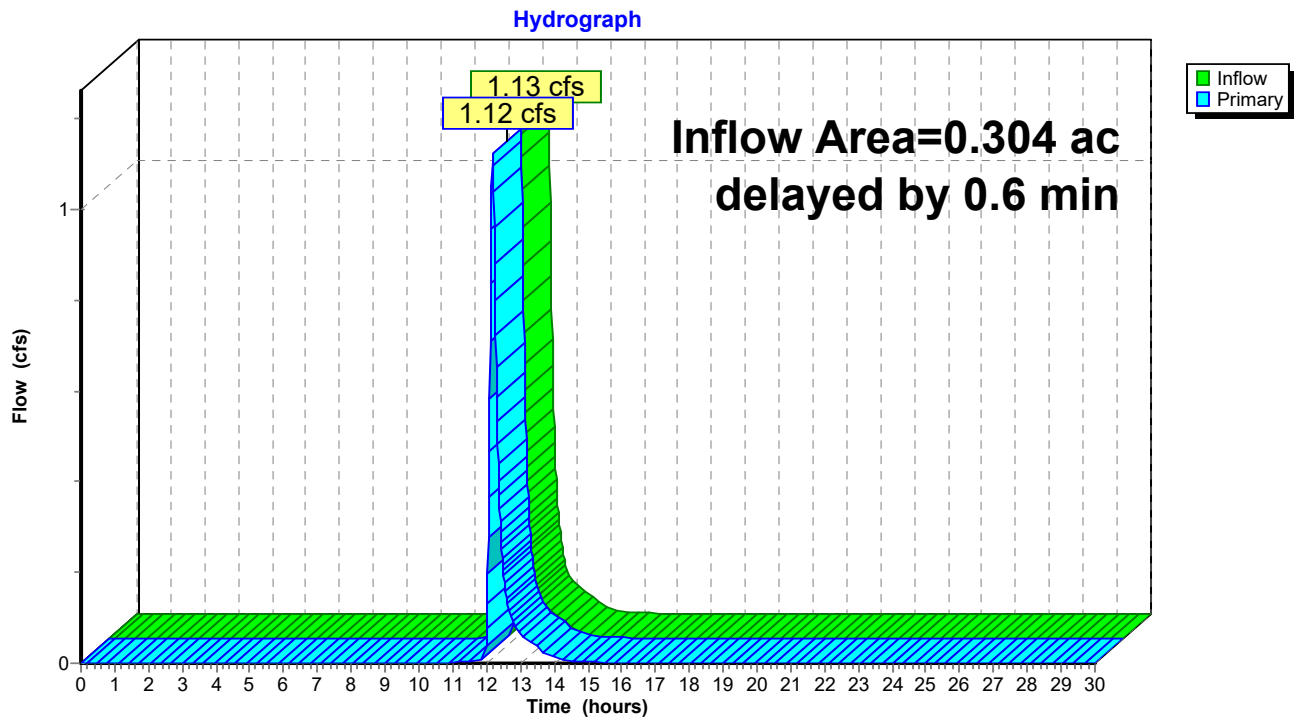
Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP1: Oakland St. Catch Basin (CB 2)

Summary for Link DP1-1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.304 ac, 81.38% Impervious, Inflow Depth = 1.30" for 10-Year event
Inflow = 1.13 cfs @ 12.17 hrs, Volume= 0.033 af
Primary = 1.12 cfs @ 12.18 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.6 min
Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

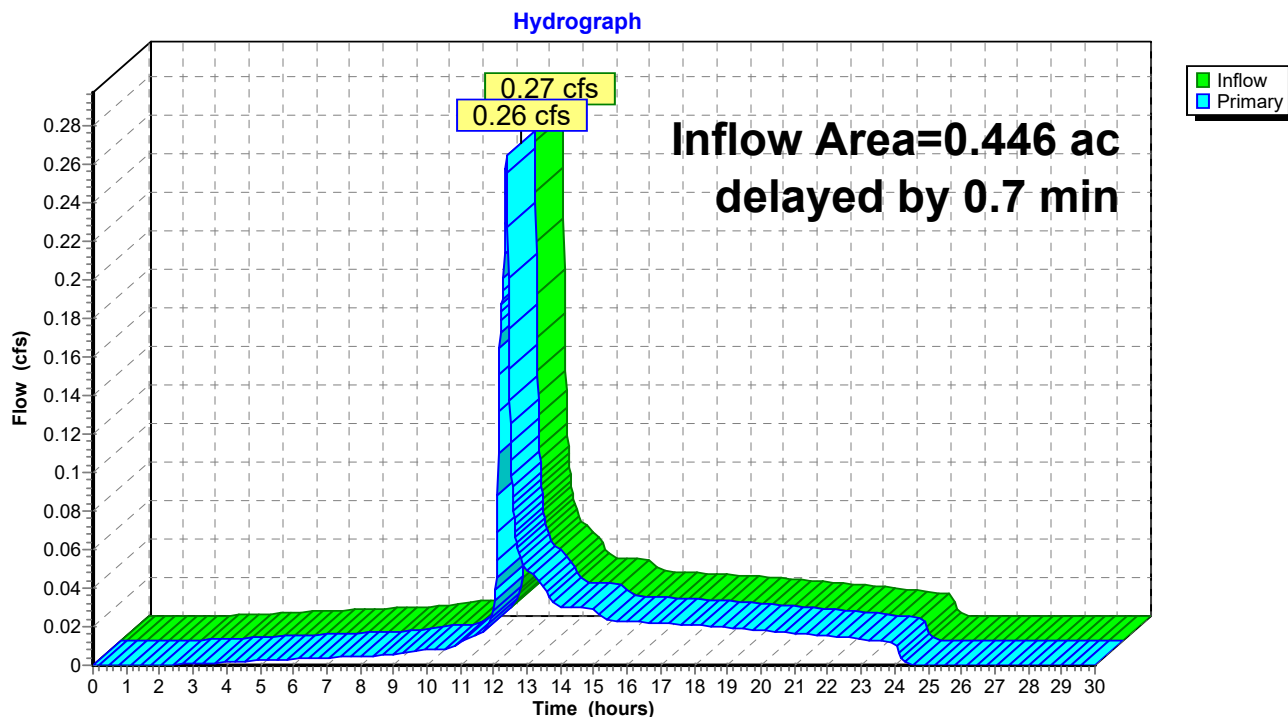
Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP1-1: Oakland St. Catch Basin (CB 2)

Summary for Link DP2: Overland to City Drain (CB 8) via Lot 97

Inflow Area = 0.446 ac, 30.85% Impervious, Inflow Depth = 0.89" for 10-Year event
Inflow = 0.27 cfs @ 12.37 hrs, Volume= 0.033 af
Primary = 0.26 cfs @ 12.38 hrs, Volume= 0.033 af, Atten= 0%, Lag= 0.7 min
Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

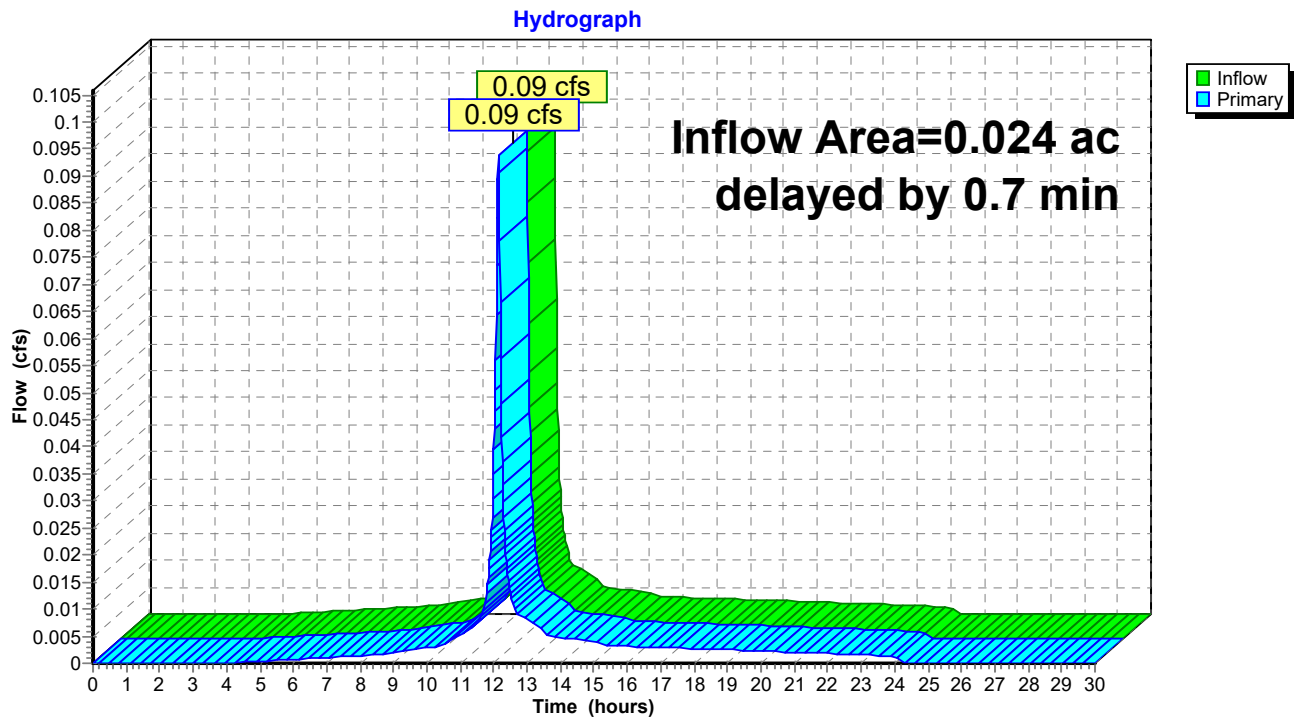
Primary outflow = Inflow delayed by 0.7 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP2: Overland to City Drain (CB 8) via Lot 97

Summary for Link DP2-1: Overland to City Drain (CB 8) via Lot 97

Inflow Area = 0.024 ac, 0.00% Impervious, Inflow Depth = 3.21" for 10-Year event
Inflow = 0.09 cfs @ 12.13 hrs, Volume= 0.007 af
Primary = 0.09 cfs @ 12.14 hrs, Volume= 0.007 af, Atten= 1%, Lag= 0.7 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

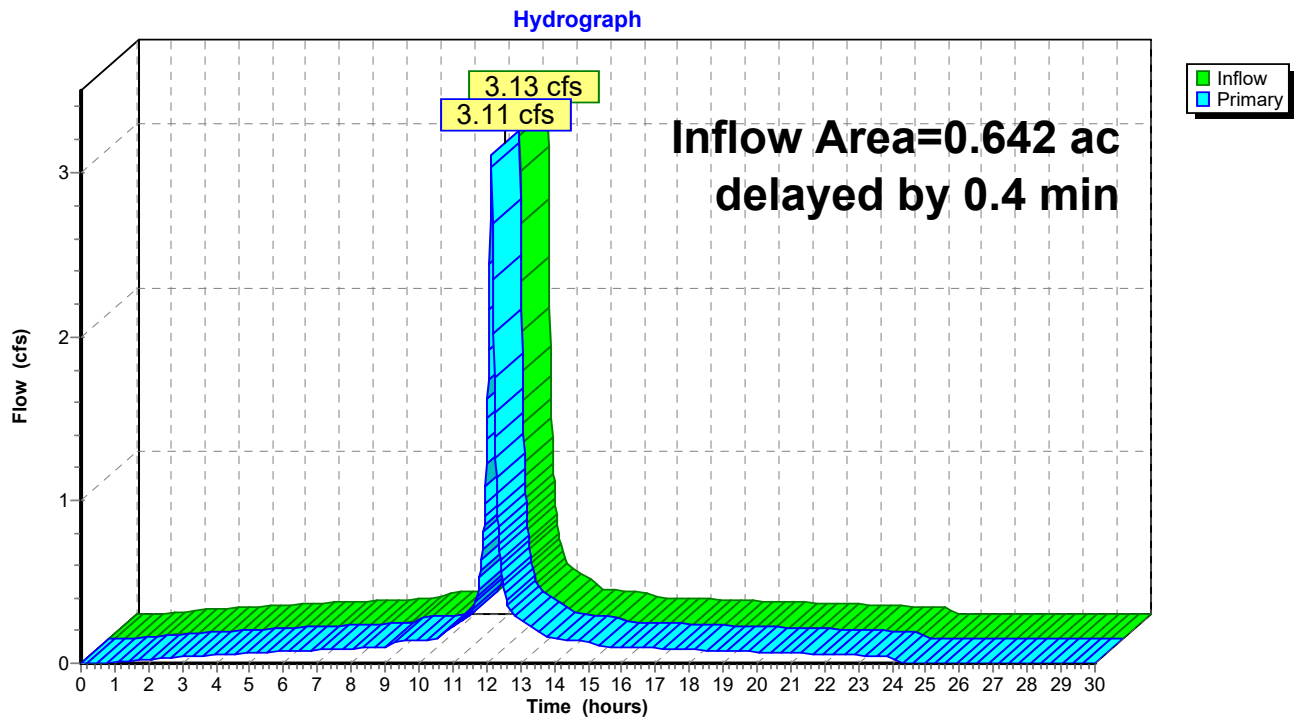
Primary outflow = Inflow delayed by 0.7 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP2-1: Overland to City Drain (CB 8) via Lot 97

Summary for Link DP3: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.642 ac, 98.80% Impervious, Inflow Depth = 4.81" for 10-Year event
Inflow = 3.13 cfs @ 12.14 hrs, Volume= 0.257 af
Primary = 3.11 cfs @ 12.14 hrs, Volume= 0.257 af, Atten= 1%, Lag= 0.4 min
Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

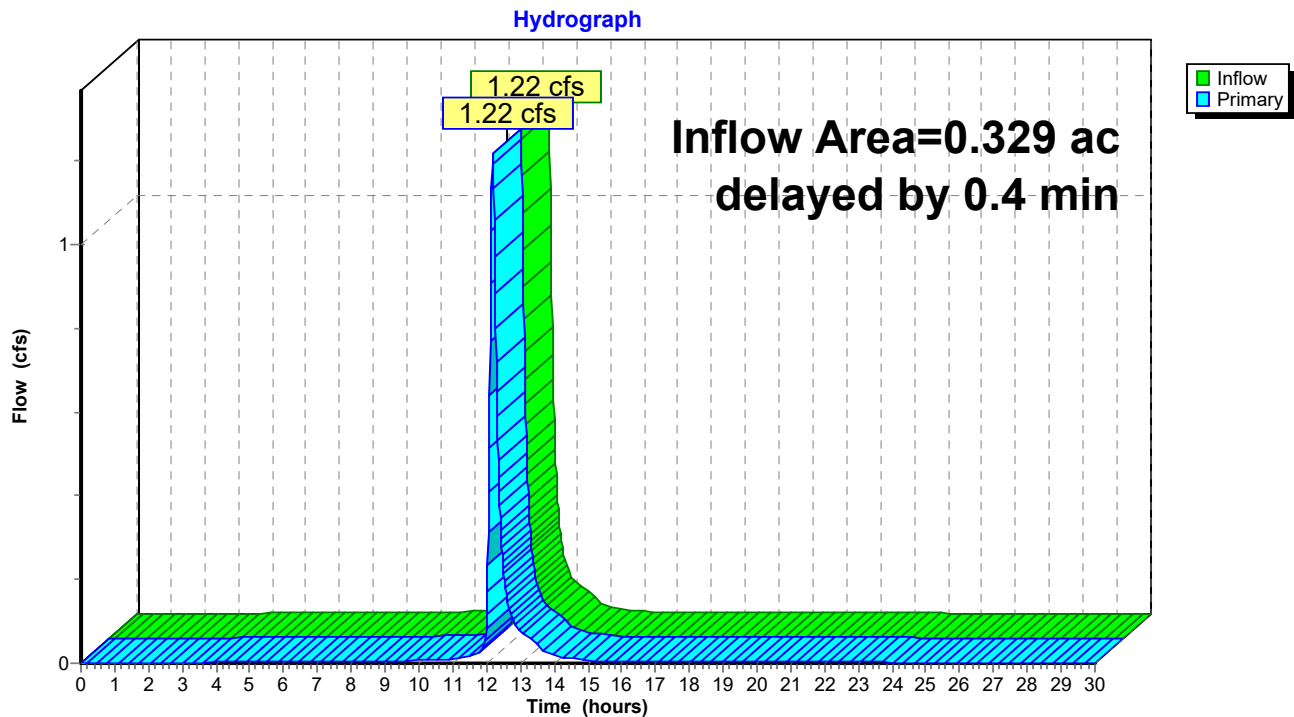
Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3: Chestnut St. Drain Manhole (DMH 3)

Summary for Link DP3-1: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.329 ac, 82.42% Impervious, Inflow Depth = 1.57" for 10-Year event
Inflow = 1.22 cfs @ 12.17 hrs, Volume= 0.043 af
Primary = 1.22 cfs @ 12.18 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.4 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

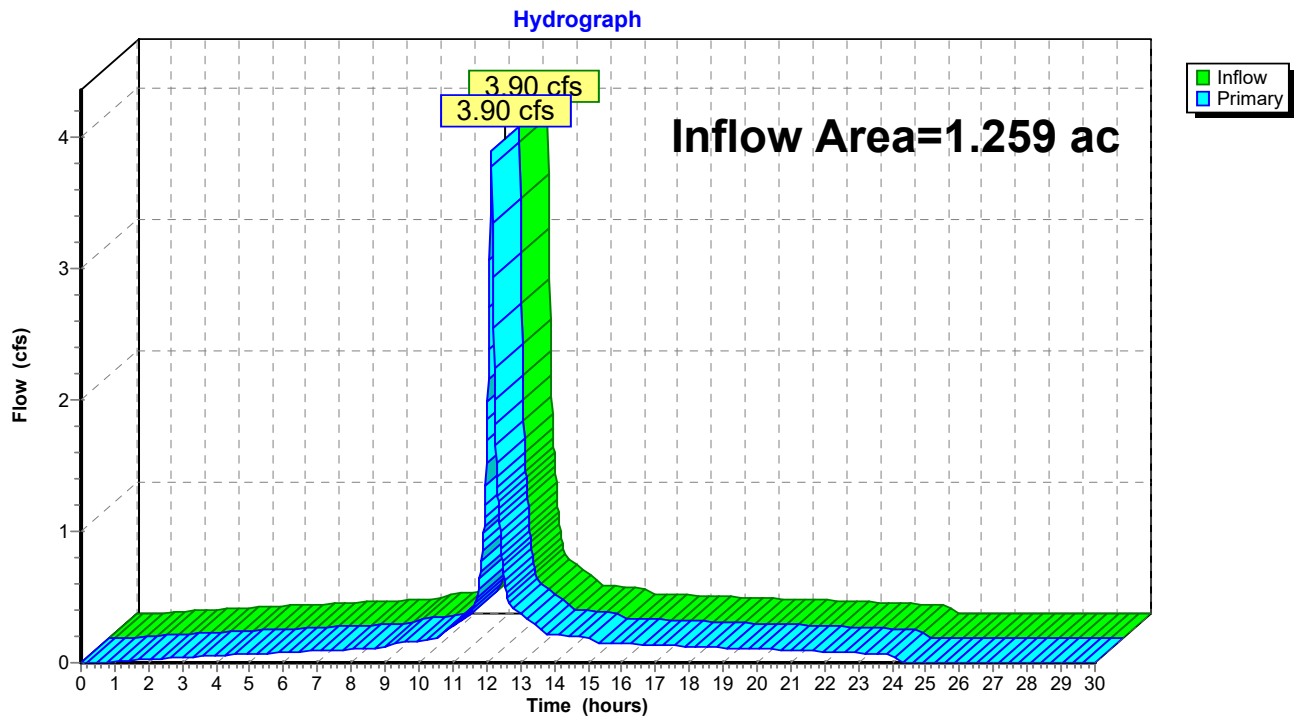
Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3-1: Chestnut St. Drain Manhole (DMH 3)

Summary for Link DP4: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 69.90% Impervious, Inflow Depth = 3.20" for 10-Year event
Inflow = 3.90 cfs @ 12.14 hrs, Volume= 0.336 af
Primary = 3.90 cfs @ 12.14 hrs, Volume= 0.336 af, Atten= 0%, Lag= 0.0 min

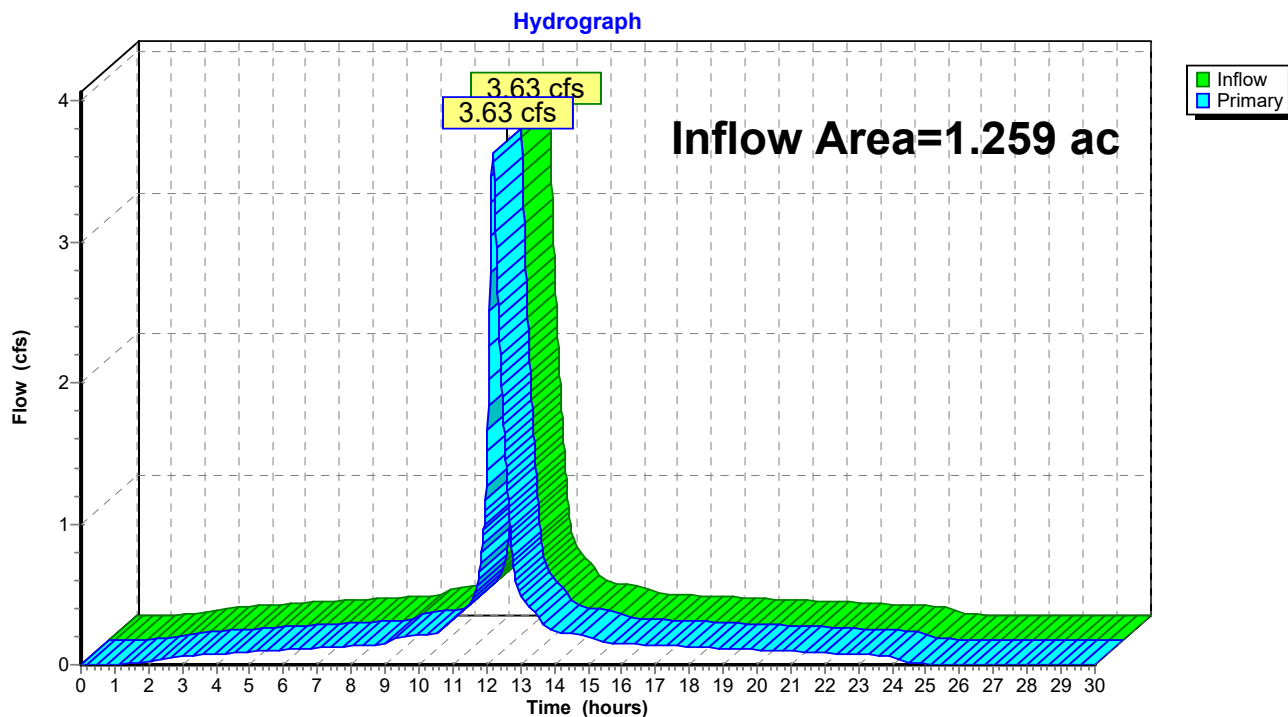
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP4: Chestnut St. Drain Manhole (DMH 4)

Summary for Link DP4-1: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 91.44% Impervious, Inflow Depth = 3.95" for 10-Year event
Inflow = 3.63 cfs @ 12.18 hrs, Volume= 0.415 af
Primary = 3.63 cfs @ 12.18 hrs, Volume= 0.415 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

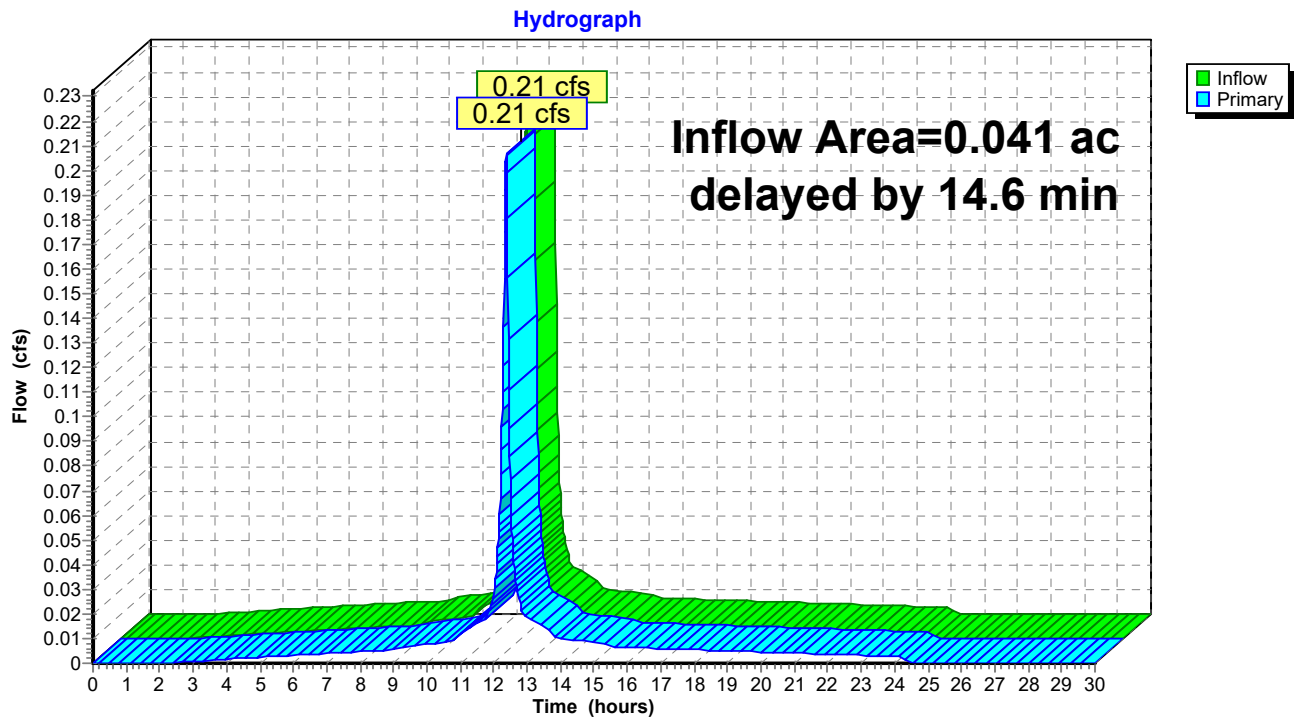
Link DP4-1: Chestnut St. Drain Manhole (DMH 4)

Summary for Link L2: Lag Time for Flow from S2B to DP2

Inflow Area = 0.041 ac, 93.46% Impervious, Inflow Depth = 4.43" for 10-Year event
 Inflow = 0.21 cfs @ 12.13 hrs, Volume= 0.015 af
 Primary = 0.21 cfs @ 12.37 hrs, Volume= 0.015 af, Atten= 0%, Lag= 14.6 min
 Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 14.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link L2: Lag Time for Flow from S2B to DP2

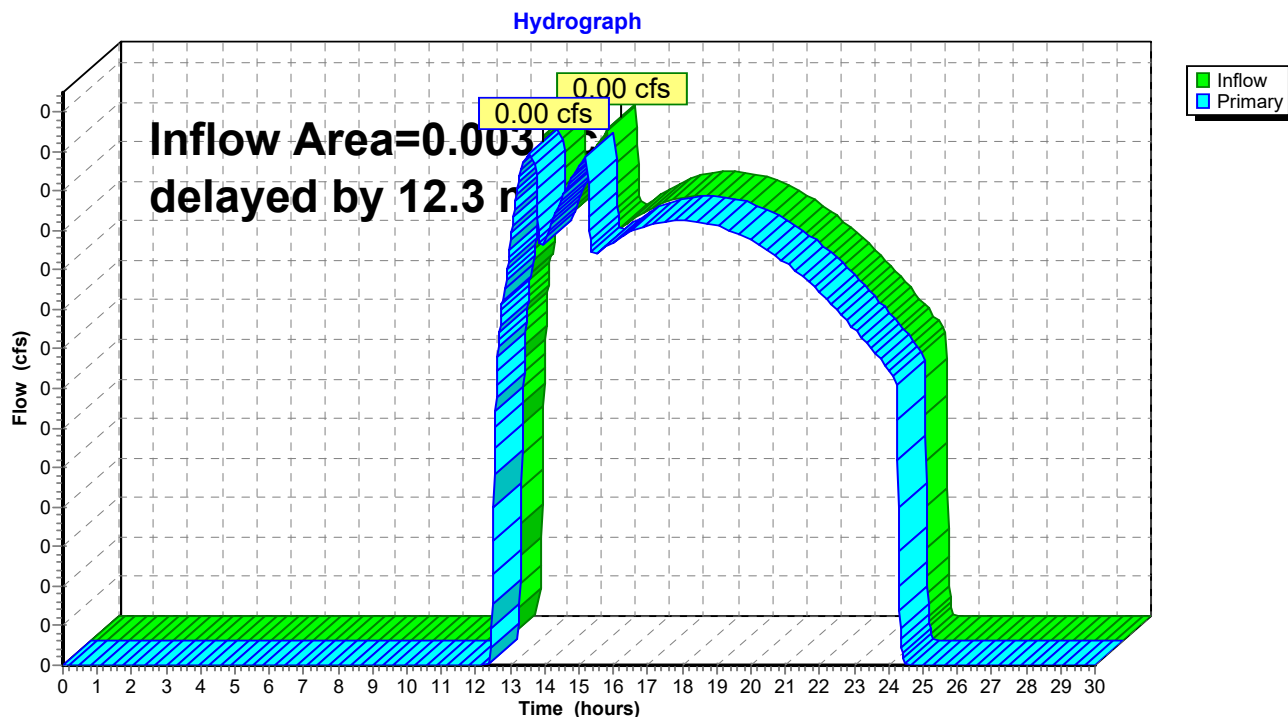


Summary for Link L2-1: Lag Time for Flow from S2B-1 to DP2-1

Inflow Area = 0.003 ac, 0.00% Impervious, Inflow Depth = 0.22" for 10-Year event
 Inflow = 0.00 cfs @ 15.01 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 13.55 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
 Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 12.3 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link L2-1: Lag Time for Flow from S2B-1 to DP2-1



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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S1: Parking & Front of Buildings

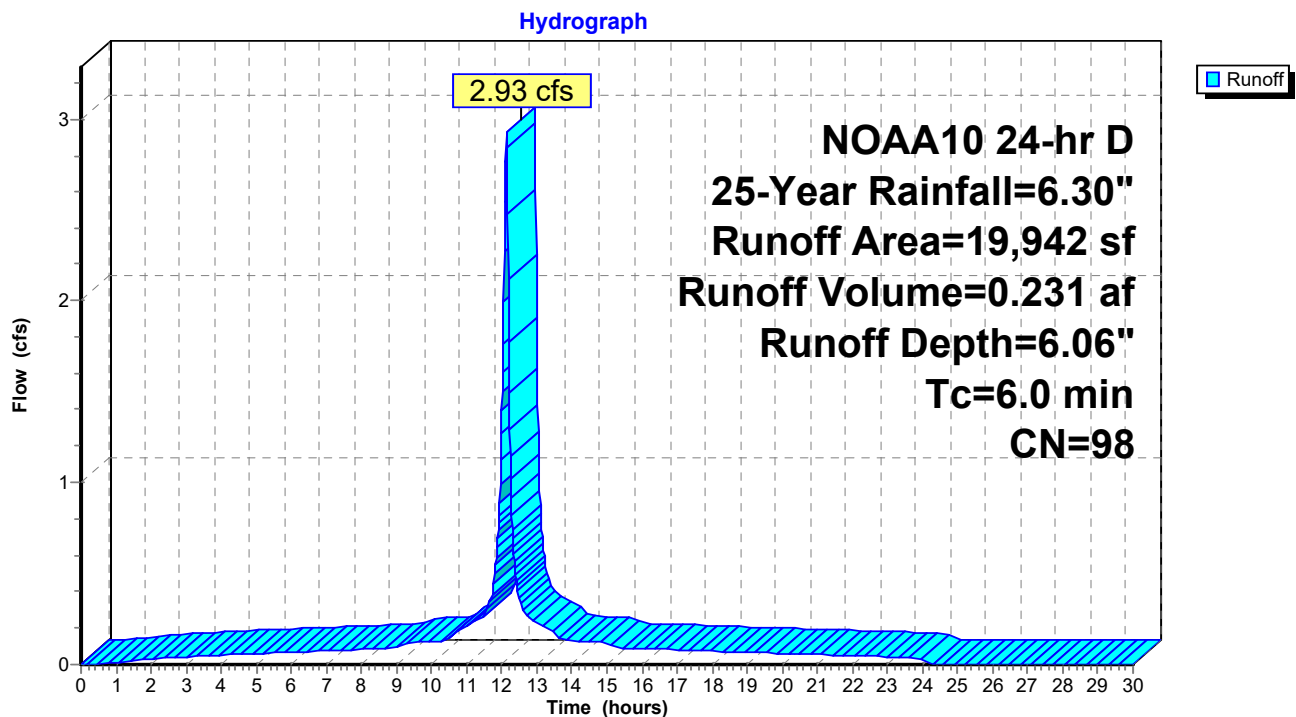
Runoff = 2.93 cfs @ 12.13 hrs, Volume= 0.231 af, Depth= 6.06"

Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
12,479	98	Paved parking, HSG A
7,463	98	Roofs, HSG A
19,942	98	Weighted Average
19,942		100.00% Impervious Area

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

Subcatchment S1: Parking & Front of Buildings

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Summary for Subcatchment S1-1: Drains to Parking Lot Chambers

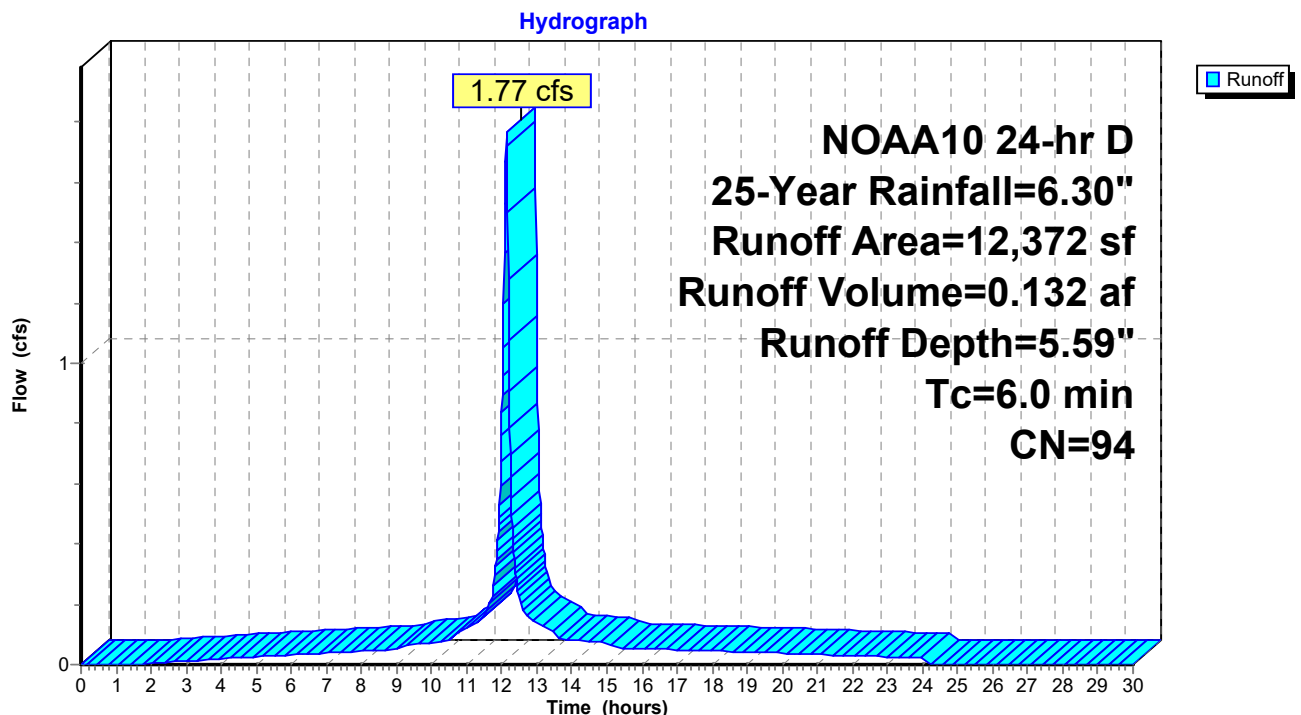
Runoff = 1.77 cfs @ 12.13 hrs, Volume= 0.132 af, Depth= 5.59"

Routed to Pond CDS1 : Water Quality Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
717	39	>75% Grass cover, Good, HSG A
1,237	96	Gravel surface, HSG A
10,418	98	Paved parking, HSG A
12,372	94	Weighted Average
1,954		15.79% Pervious Area
10,418		84.21% Impervious Area

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

Subcatchment S1-1: Drains to Parking Lot Chambers

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Summary for Subcatchment S1-2: Untreated Runoff onto Oakland St.

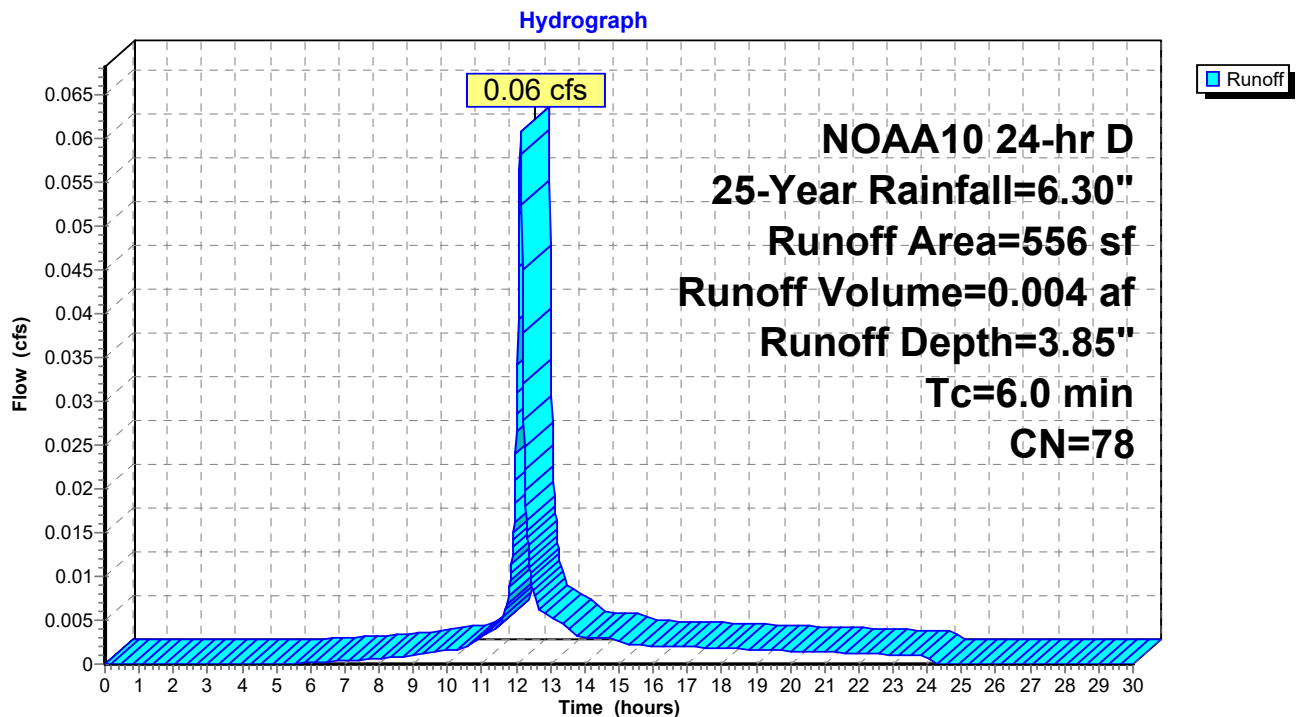
Runoff = 0.06 cfs @ 12.13 hrs, Volume= 0.004 af, Depth= 3.85"

Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
191	39	>75% Grass cover, Good, HSG A
365	98	Paved parking, HSG A
556	78	Weighted Average
191		34.35% Pervious Area
365		65.65% Impervious Area

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

Subcatchment S1-2: Untreated Runoff onto Oakland St.

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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S2A: Easterly Roof & Lot Line

Runoff = 0.25 cfs @ 12.24 hrs, Volume= 0.027 af, Depth= 5.25"

Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

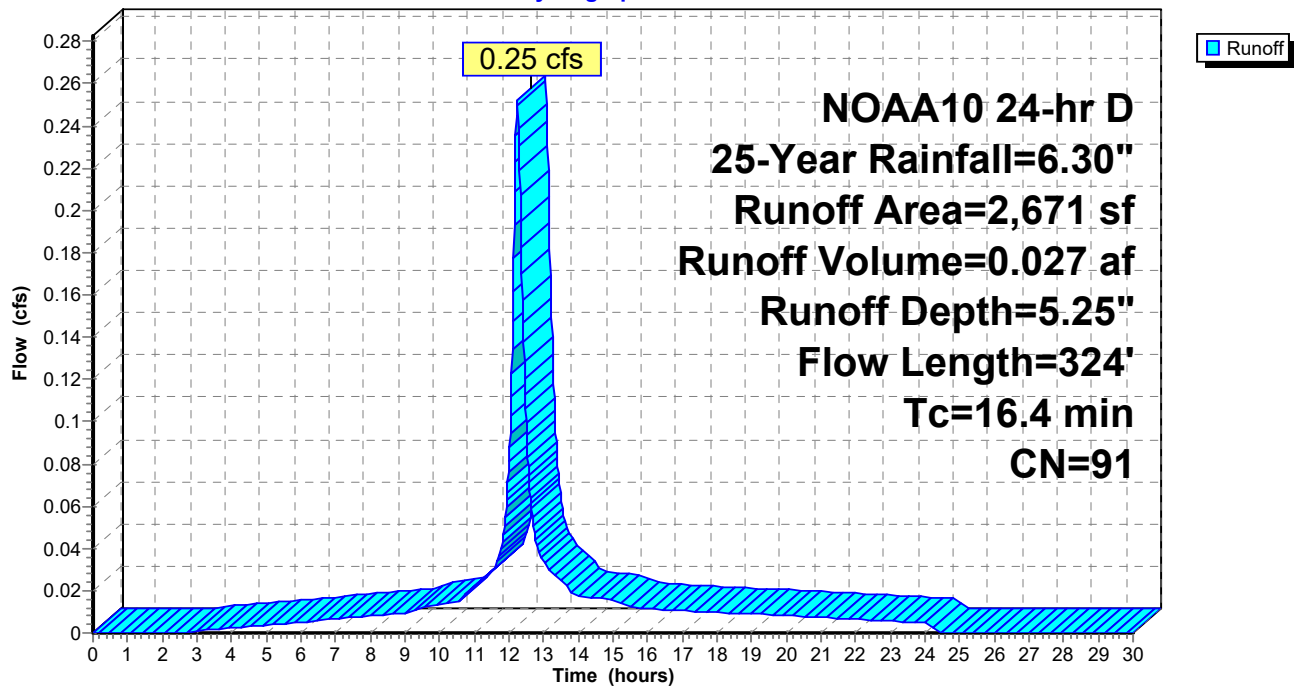
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
322	39	>75% Grass cover, Good, HSG A
2,349	98	Unconnected roofs, HSG A
2,671	91	Weighted Average
322		12.06% Pervious Area
2,349		87.94% Impervious Area
2,349		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A: Easterly Roof & Lot Line

Hydrograph



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Summary for Subcatchment S2A-1: Easterly Lot Line

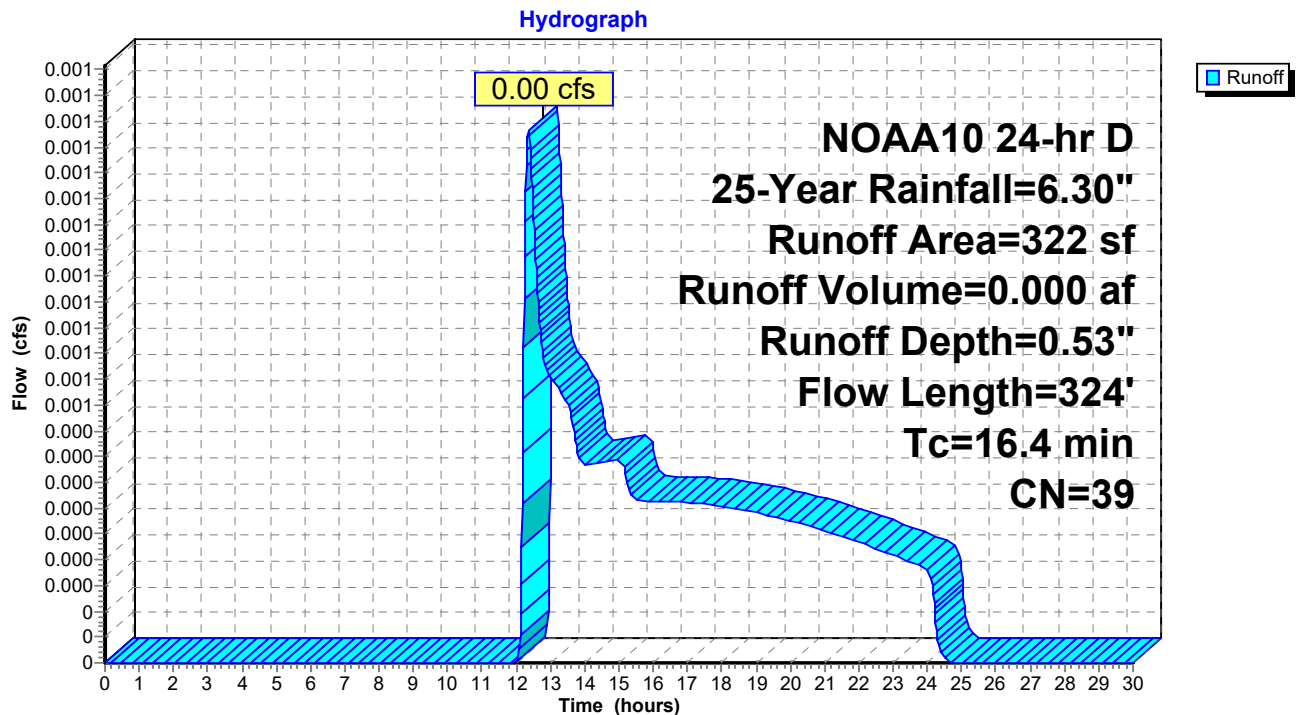
Runoff = 0.00 cfs @ 12.36 hrs, Volume= 0.000 af, Depth= 0.53"

Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
322	39	>75% Grass cover, Good, HSG A
322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A-1: Easterly Lot Line

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Summary for Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

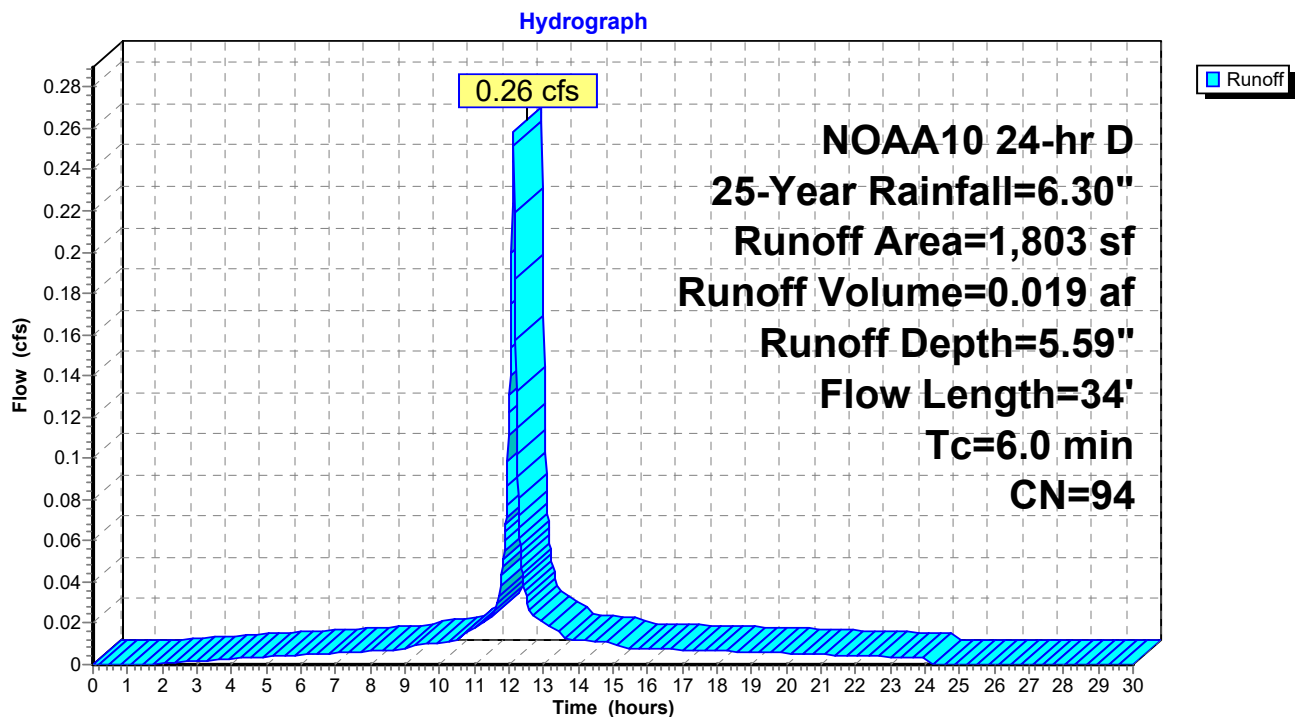
Runoff = 0.26 cfs @ 12.13 hrs, Volume= 0.019 af, Depth= 5.59"

Routed to Link L2 : Lag Time for Flow from S2B to DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
1,685	98	Unconnected roofs, HSG A
1,803	94	Weighted Average
118		6.54% Pervious Area
1,685		93.46% Impervious Area
1,685		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	34		0.09		Direct Entry, Assumed Minimum

Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214

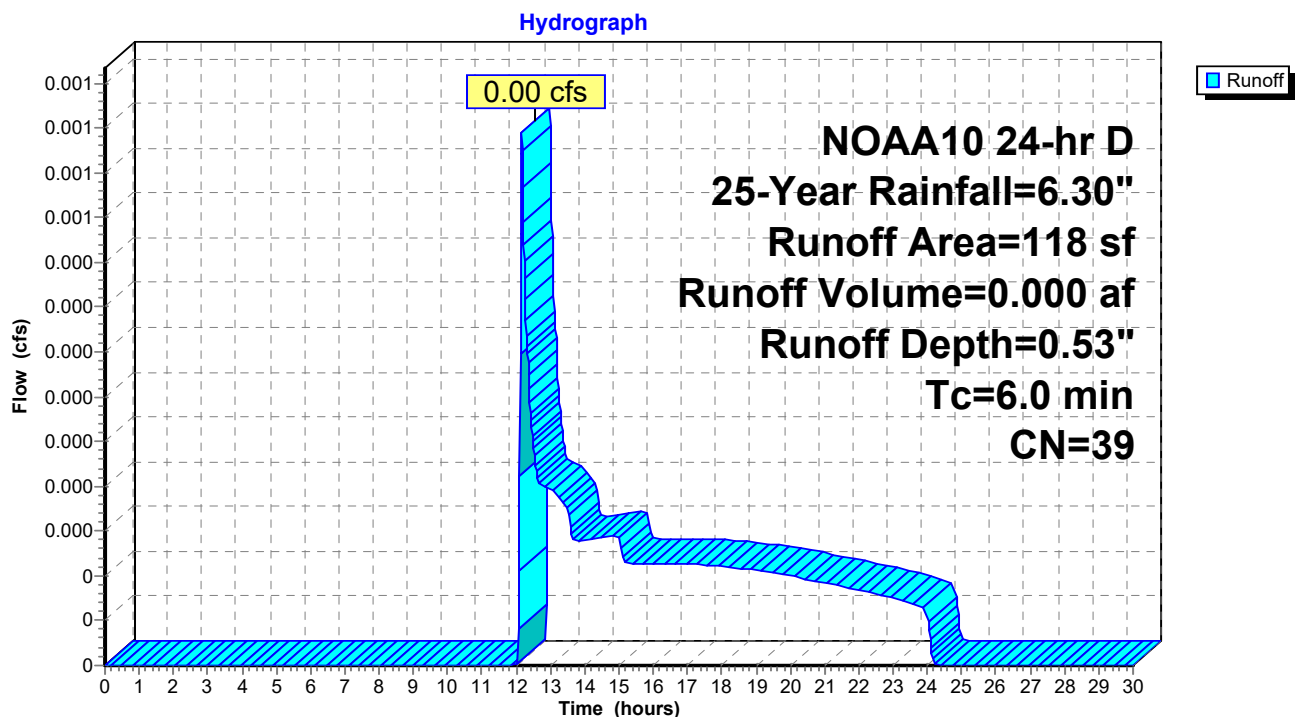
Runoff = 0.00 cfs @ 12.17 hrs, Volume= 0.000 af, Depth= 0.53"

Routed to Link L2-1 : Lag Time for Flow from S2B-1 to DP2-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
118		100.00% Pervious Area

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

Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214

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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S2C: Rear of Building & Site (SW)

Runoff = 0.34 cfs @ 12.17 hrs, Volume= 0.034 af, Depth= 1.00"

Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

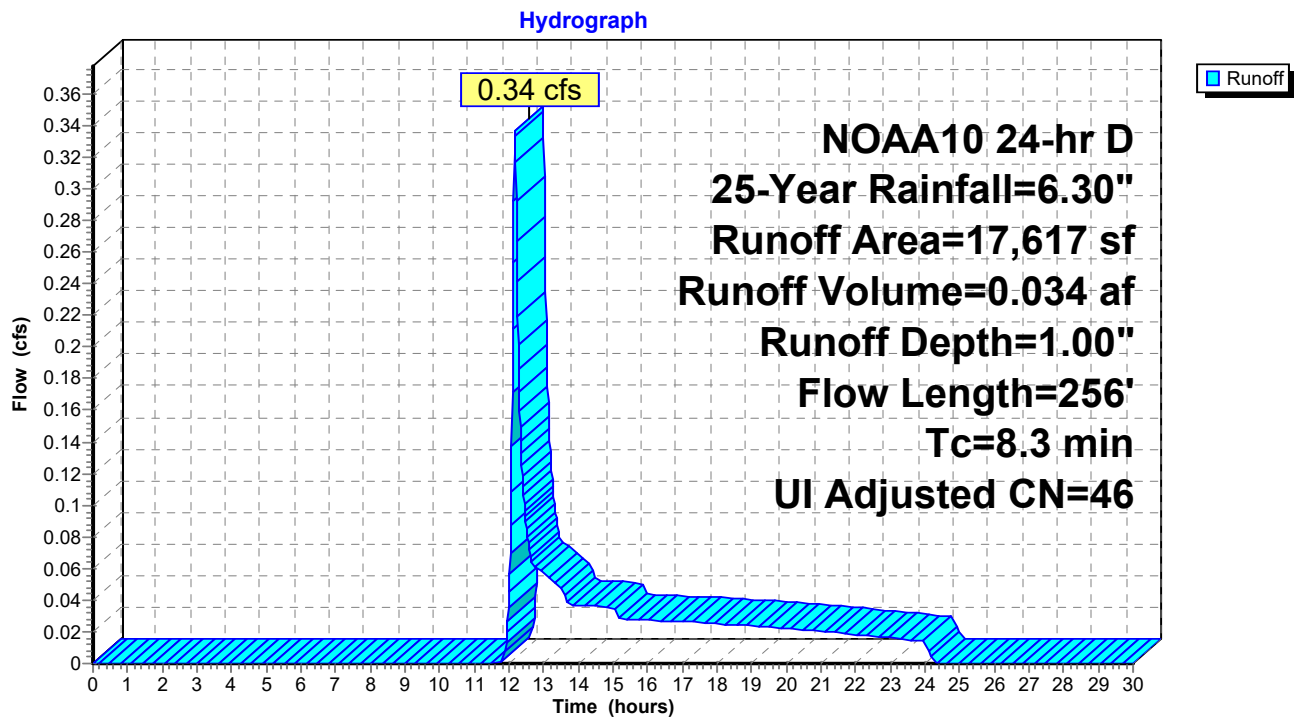
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Adj	Description
1,157	39		>75% Grass cover, Good, HSG A
80	98		Paved parking, HSG A
4,226	98		Unconnected roofs, HSG A
2,147	77		Fallow, bare soil, HSG A
10,007	30		Woods, Good, HSG A
17,617	53	46	Weighted Average, UI Adjusted
13,311			75.56% Pervious Area
4,306			24.44% Impervious Area
4,226			98.14% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	53	0.4720	0.24		Sheet Flow, Wooded Slope Woods: Light underbrush n= 0.400 P2= 3.24"
4.5	177	0.0169	0.65		Shallow Concentrated Flow, Wooded Swale Woodland Kv= 5.0 fps
0.2	26	0.0169	1.95		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
8.3	256	Total			

Subcatchment S2C: Rear of Building & Site (SW)



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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S2C-1: Perimeter of Garage

Runoff = 0.12 cfs @ 12.13 hrs, Volume= 0.009 af, Depth= 4.70"

Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

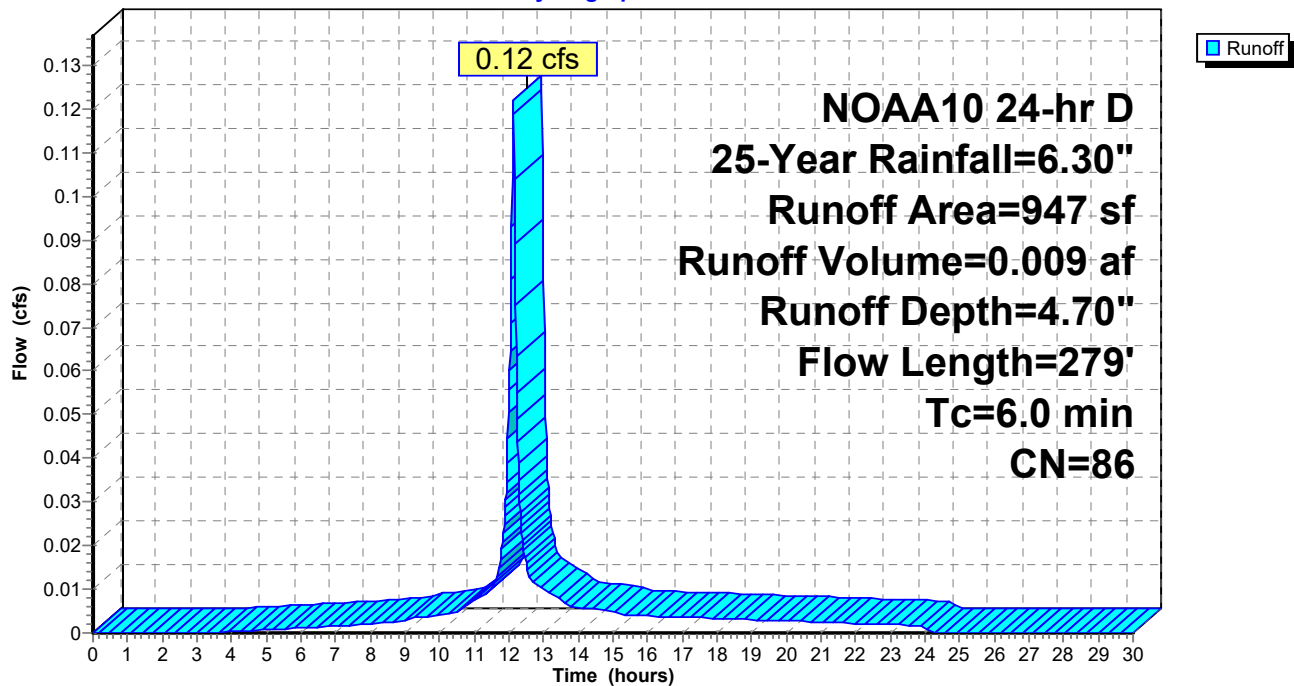
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
167	39	>75% Grass cover, Good, HSG A
780	96	Gravel surface, HSG A
947	86	Weighted Average
947		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	51	0.0451	0.21		Sheet Flow, Grassed Slope Grass: Short n= 0.150 P2= 3.24"
1.5	205	0.0195	2.25		Shallow Concentrated Flow, Stone Dust Walkway Unpaved Kv= 16.1 fps
0.3	23	0.0098	1.48		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
5.9	279	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S2C-1: Perimeter of Garage

Hydrograph



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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S3: Corner of Oakland & Chestnut (NE)

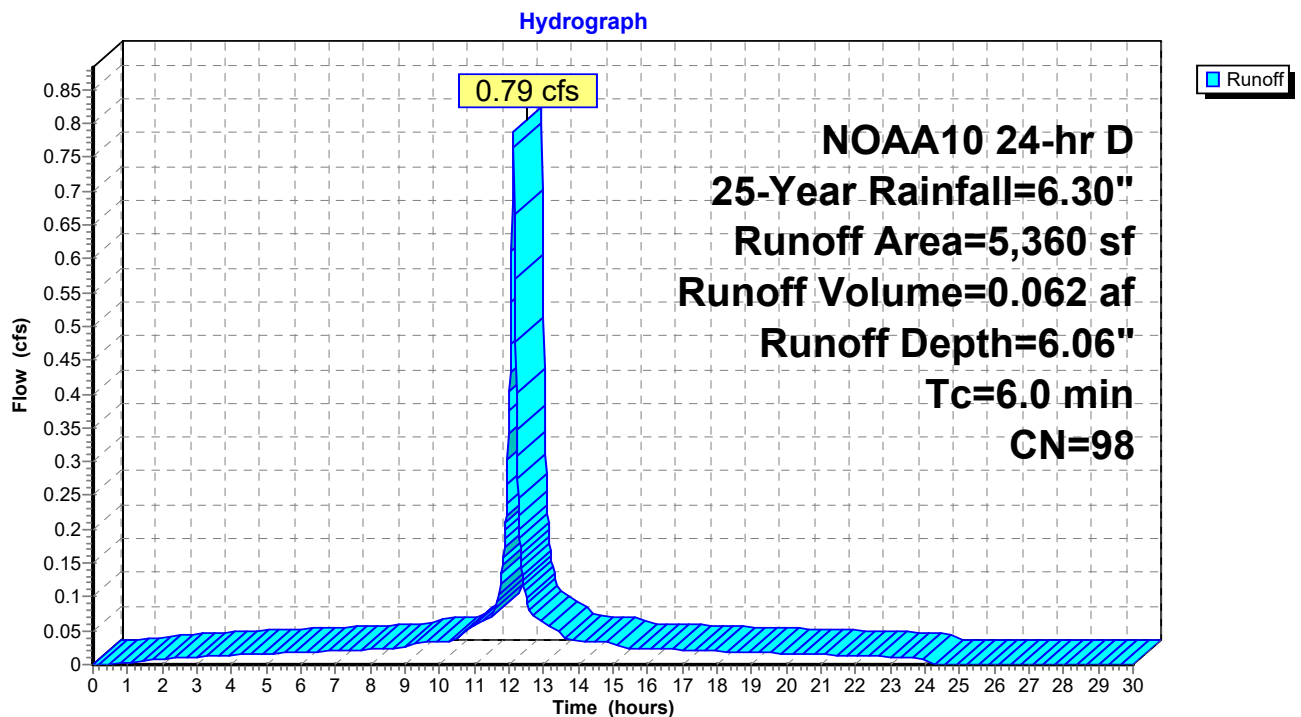
Runoff = 0.79 cfs @ 12.13 hrs, Volume= 0.062 af, Depth= 6.06"

Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
14	39	>75% Grass cover, Good, HSG A
1,053	98	Paved parking, HSG A
4,293	98	Roofs, HSG A
5,360	98	Weighted Average
14		0.26% Pervious Area
5,346		99.74% Impervious Area

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

Subcatchment S3: Corner of Oakland & Chestnut (NE)

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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

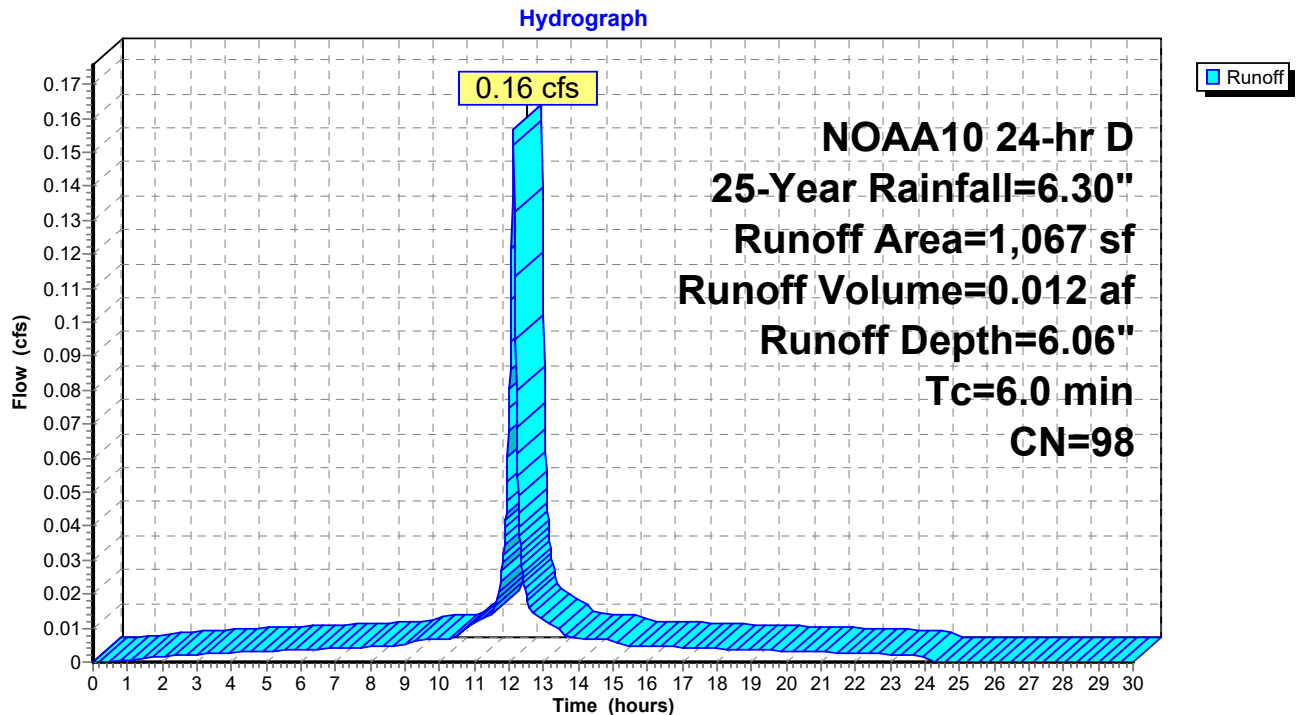
Runoff = 0.16 cfs @ 12.13 hrs, Volume= 0.012 af, Depth= 6.06"

Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
50	96	Gravel surface, HSG A
1,017	98	Paved parking, HSG A
1,067	98	Weighted Average
50		4.69% Pervious Area
1,017		95.31% Impervious Area

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

Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

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NOAA10 24-hr D 25-Year Rainfall=6.30"

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Summary for Subcatchment S4: Loading Dock

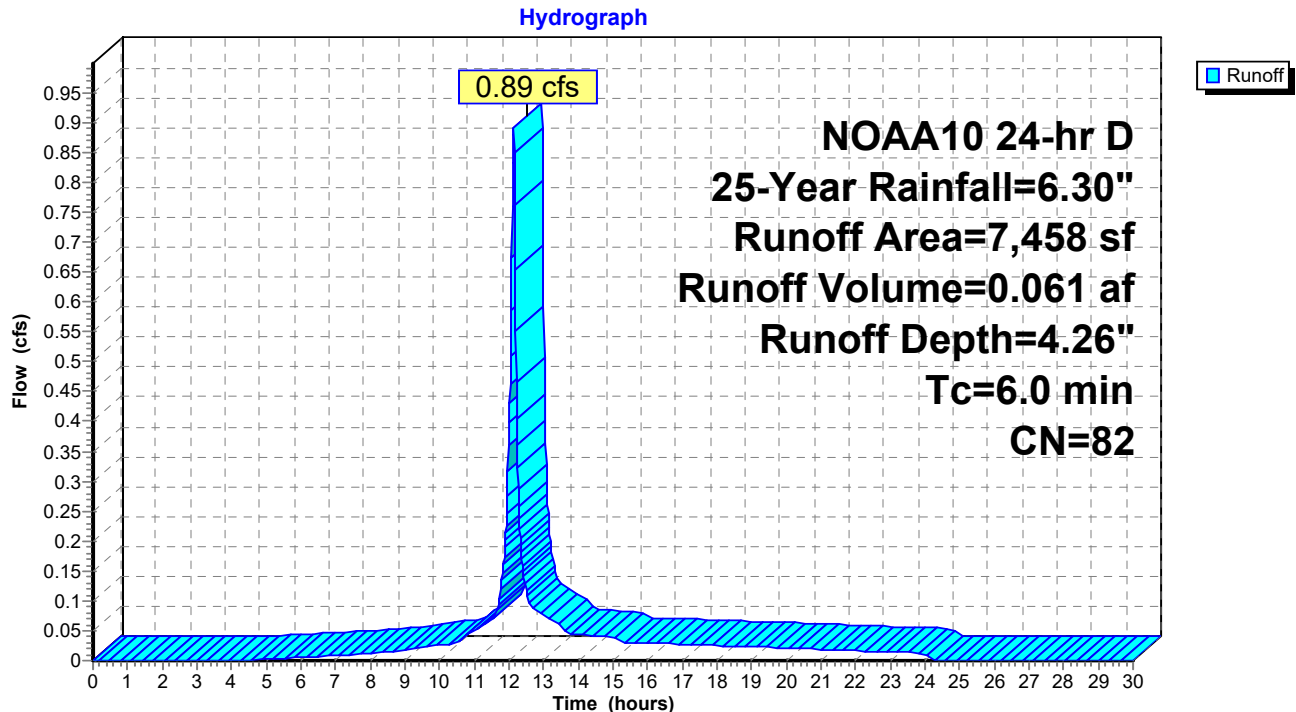
Runoff = 0.89 cfs @ 12.13 hrs, Volume= 0.061 af, Depth= 4.26"

Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
1,421	39	>75% Grass cover, Good, HSG A
2,055	98	Paved parking, HSG A
2,658	98	Roofs, HSG A
1,122	77	Fallow, bare soil, HSG A
202	30	Woods, Good, HSG A
7,458	82	Weighted Average
2,745		36.81% Pervious Area
4,713		63.19% Impervious Area

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

Subcatchment S4: Loading Dock

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Summary for Subcatchment S4-1: Garage Entrance

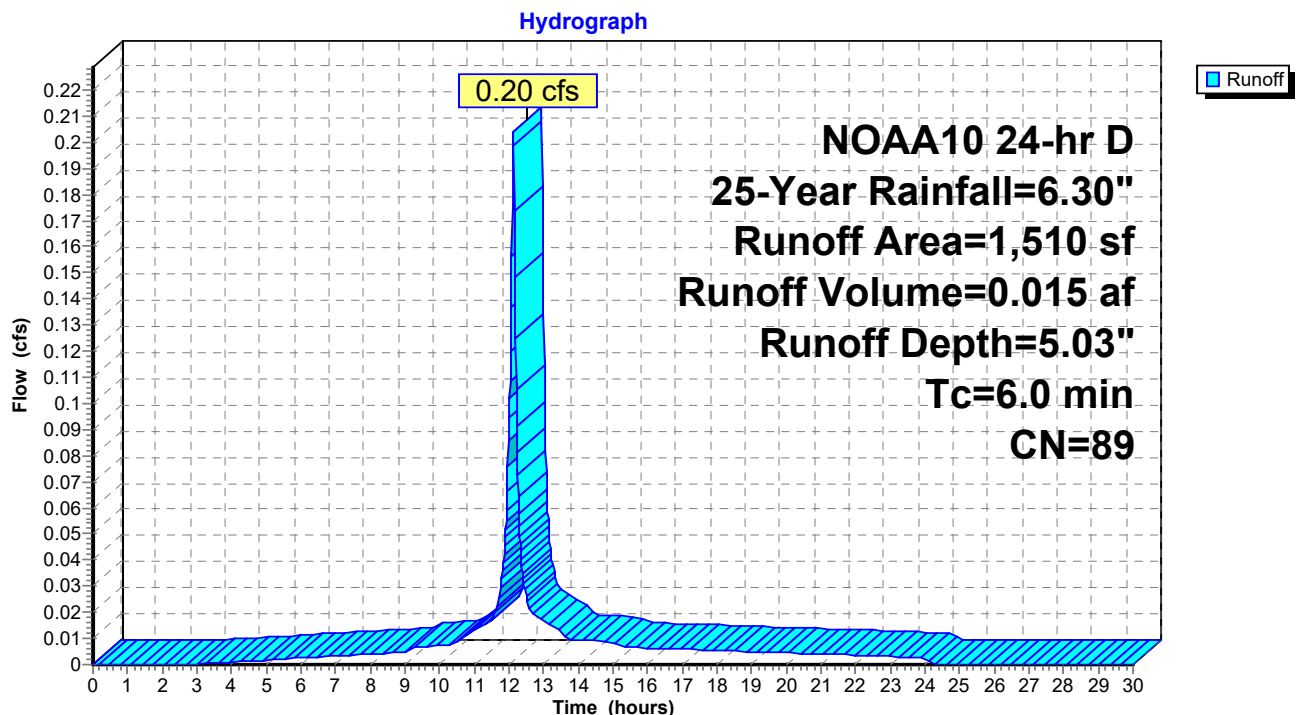
Runoff = 0.20 cfs @ 12.13 hrs, Volume= 0.015 af, Depth= 5.03"

Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
231	39	>75% Grass cover, Good, HSG A
323	96	Gravel surface, HSG A
956	98	Paved parking, HSG A
1,510	89	Weighted Average
554		36.69% Pervious Area
956		63.31% Impervious Area

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

Subcatchment S4-1: Garage Entrance

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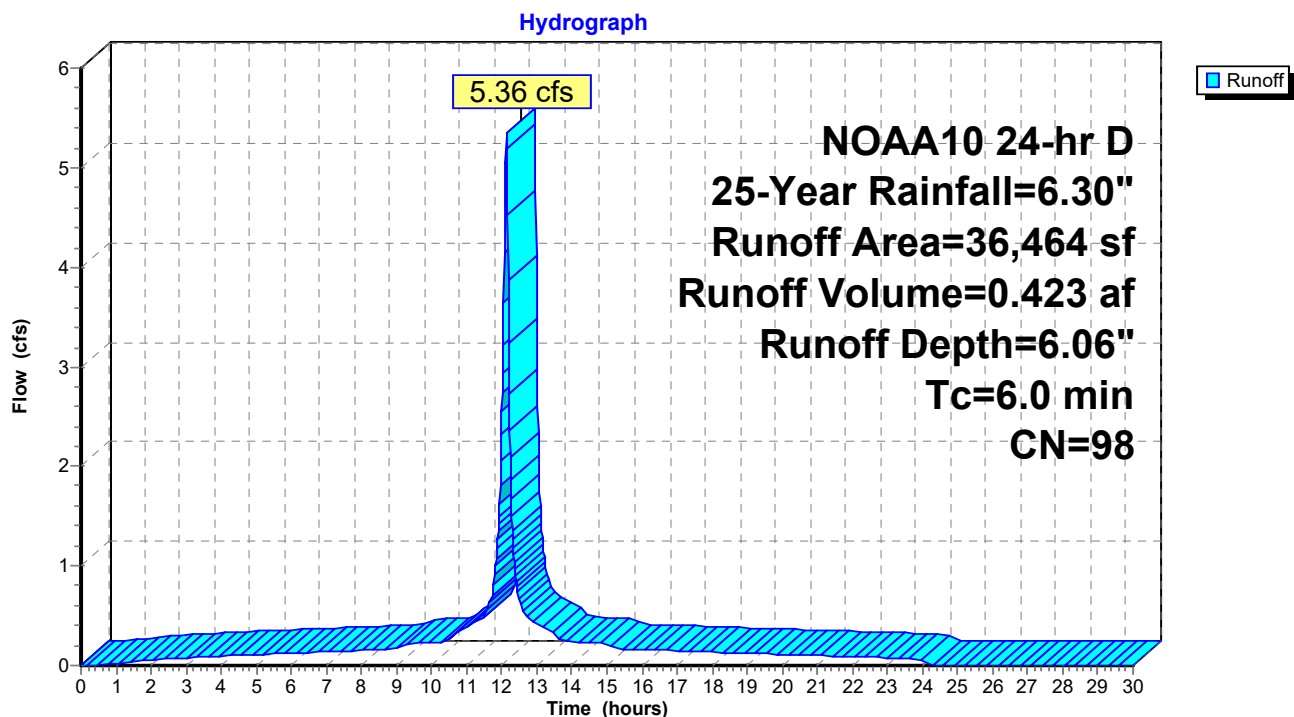
Summary for Subcatchment S4-2: Proposed Roofs

Runoff = 5.36 cfs @ 12.13 hrs, Volume= 0.423 af, Depth= 6.06"
Routed to Pond DC1 : Detention Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
36,464	98	Roofs, HSG A
36,464		100.00% Impervious Area

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

Subcatchment S4-2: Proposed Roofs

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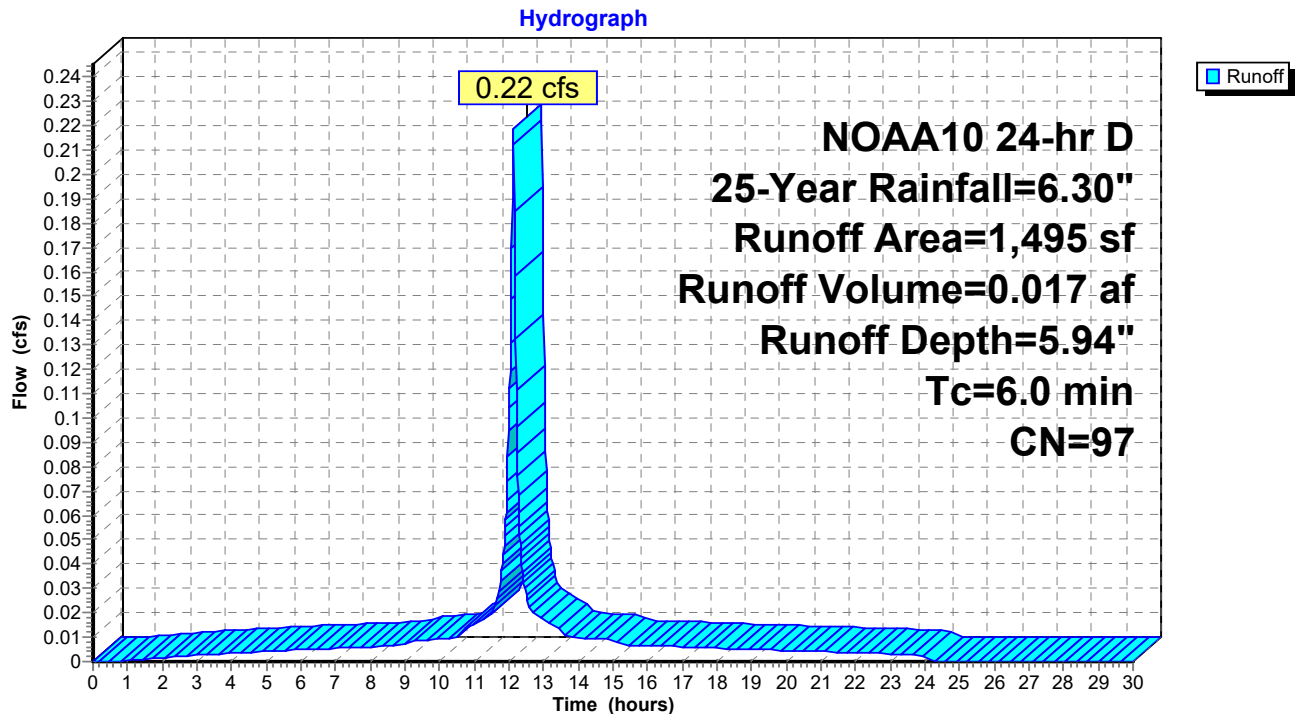
Summary for Subcatchment S4-3: Gap Between Buildings

Runoff = 0.22 cfs @ 12.13 hrs, Volume= 0.017 af, Depth= 5.94"
Routed to Pond GAP : Area Drain

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Area (sf)	CN	Description
559	96	Gravel surface, HSG A
936	98	Unconnected roofs, HSG A
1,495	97	Weighted Average
559		37.39% Pervious Area
936		62.61% Impervious Area
936		100.00% Unconnected

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

Subcatchment S4-3: Gap Between Buildings

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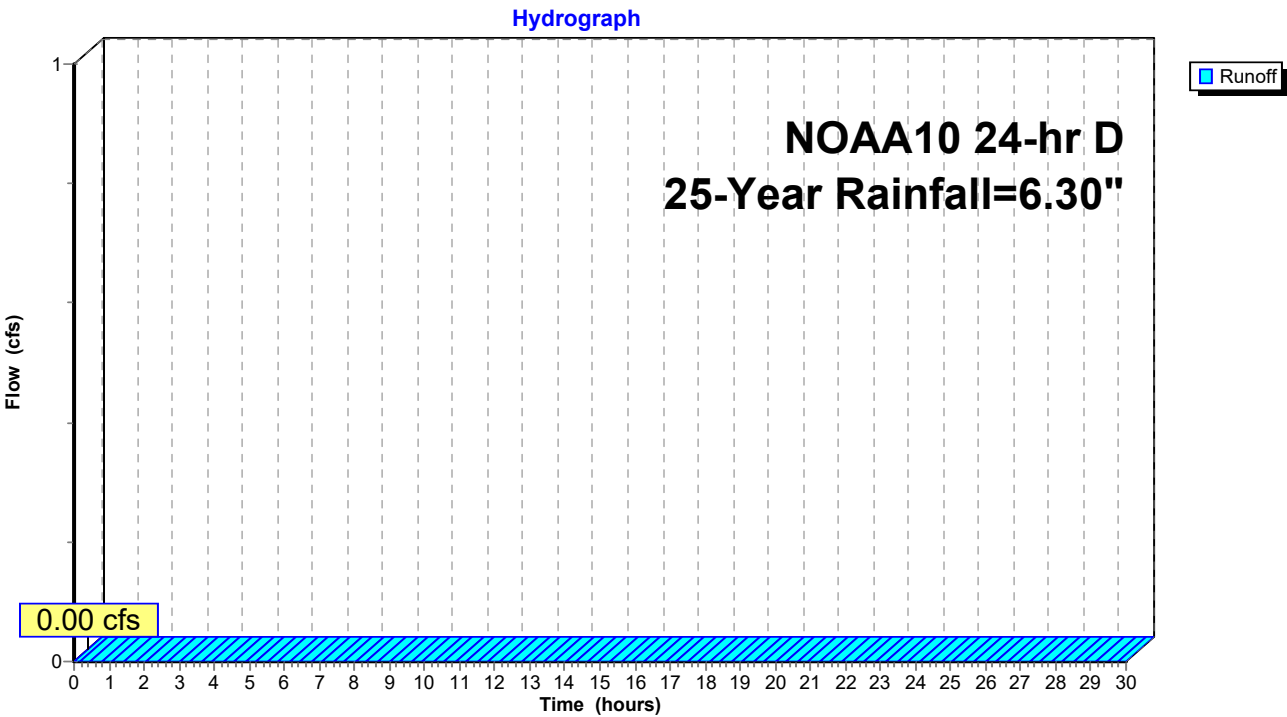
Summary for Subcatchment Tc: Extra Tc Calc's

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 25-Year Rainfall=6.30"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	70	0.0501	5.28	4.15	Pipe Channel, CB 2 to DMH 1 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.1	33	0.1391	8.80	6.91	Pipe Channel, DMH 1 to DMH 2 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.3	139	0.0701	9.18	7.21	Pipe Channel, DMH 2 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
6.3	55	0.0182	0.15		Sheet Flow, Lawn (L2 to DP2) Grass: Short n= 0.150 P2= 3.24"
0.3	27	0.0079	1.33		Shallow Concentrated Flow, Lawn (DP2 to CB 8) Grassed Waterway Kv= 15.0 fps
0.4	47	0.0079	1.80		Shallow Concentrated Flow, Chestnut St. Gutter (DP2 to CB 8) Paved Kv= 20.3 fps
0.0	9	0.0811	9.88	7.76	Pipe Channel, CB 8 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
0.4	143	0.0222	6.77	11.97	Pipe Channel, DMH 3 to DMH 4 18.00" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.017 Concrete sewer w/manholes & inlets
8.0	523	Total			

Subcatchment Tc: Extra Tc Calc's



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Summary for Pond CDS1: Water Quality Catch Basin

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 5.59" for 25-Year event
Inflow = 1.77 cfs @ 12.13 hrs, Volume= 0.132 af
Outflow = 1.77 cfs @ 12.13 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.0 min
Primary = 1.77 cfs @ 12.13 hrs, Volume= 0.132 af
Routed to Pond IC2 : Infiltration Chamber Under Parking Lot

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 51.76' @ 12.13 hrs

Flood Elev= 52.00'

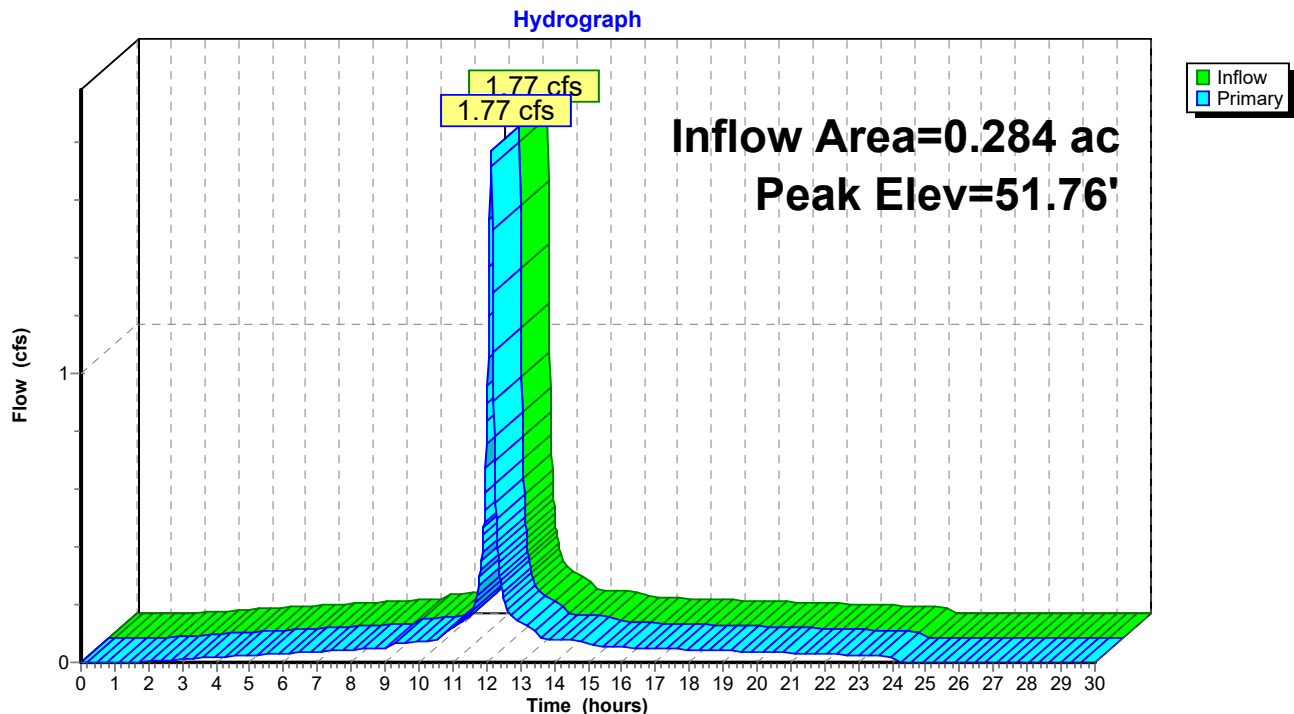
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 ' S= 0.0089 ' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=1.76 cfs @ 12.13 hrs HW=51.76' TW=50.22' (Dynamic Tailwater)

1=RCP Culvert (SD-3) (Passes 1.76 cfs of 4.69 cfs potential flow)

2=Neenah R1878-A6G Grate (Weir Controls 1.76 cfs @ 1.30 fps)

Pond CDS1: Water Quality Catch Basin



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Summary for Pond DC1: Detention Chamber

Inflow Area = 0.871 ac, 98.53% Impervious, Inflow Depth = 6.06" for 25-Year event
 Inflow = 5.58 cfs @ 12.13 hrs, Volume= 0.440 af
 Outflow = 2.76 cfs @ 12.21 hrs, Volume= 0.440 af, Atten= 51%, Lag= 5.2 min
 Primary = 2.76 cfs @ 12.21 hrs, Volume= 0.440 af
 Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 27.38' @ 12.21 hrs Surf.Area= 543 sf Storage= 2,376 cf

Plug-Flow detention time= 13.7 min calculated for 0.439 af (100% of inflow)
 Center-of-Mass det. time= 13.5 min (760.3 - 746.7)

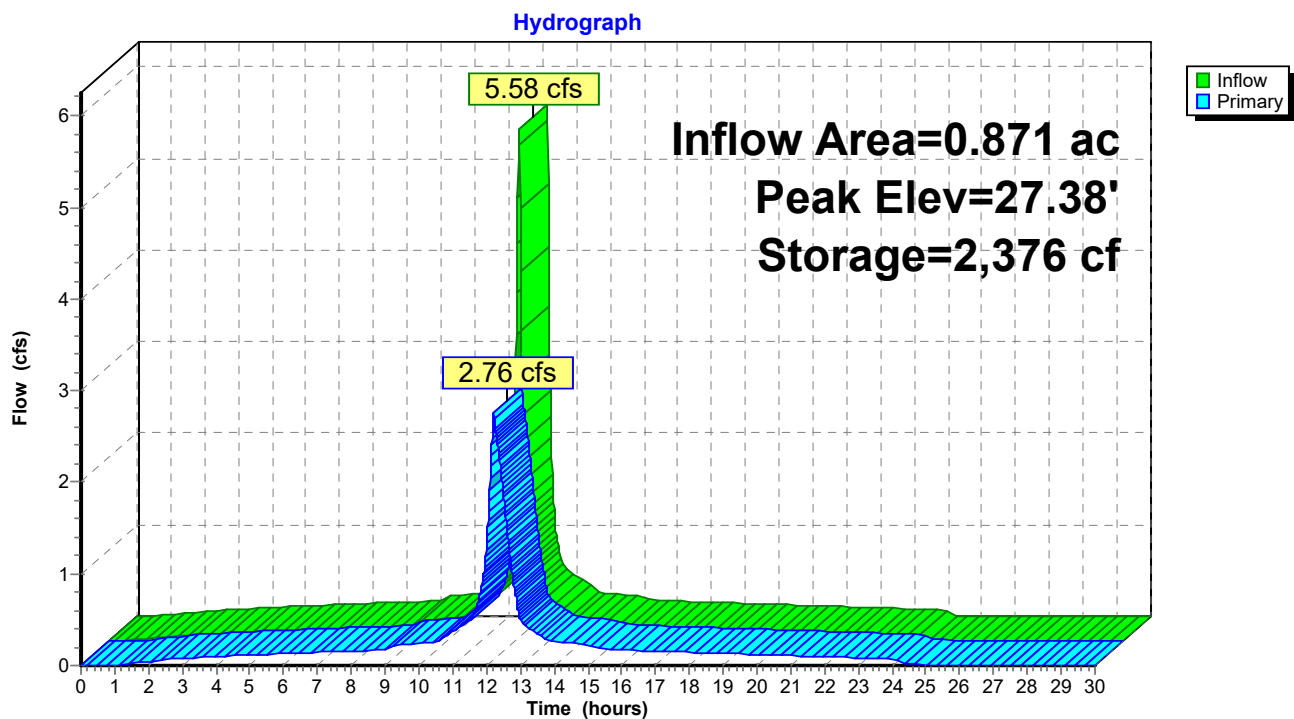
Volume	Invert	Avail.Storage	Storage Description
#1	23.01'	3,217 cf	8.67'W x 15.67'L x 5.92'H Shea Fire Cistern Bankx 4

Device	Routing	Invert	Outlet Devices
#1	Primary	23.01'	12.00" Round RCP Culvert (SD-1) L= 69.4' Ke= 1.800 Inlet / Outlet Invert= 23.01' / 22.66' S= 0.0050 '/ Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	23.01'	7.00" Vert. Control Orifice (2-yr & 10-yr) C= 0.600 Limited to weir flow at low heads
#3	Device 1	27.25'	4.00" Vert. Control Orifice (25-yr) X 4.00 C= 0.600 Limited to weir flow at low heads
#4	Device 1	28.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Primary OutFlow Max=2.75 cfs @ 12.21 hrs HW=27.38' TW=0.00' (Dynamic Tailwater)

- 1=RCP Culvert (SD-1) (Passes 2.75 cfs of 3.98 cfs potential flow)
- 2=Control Orifice (2-yr & 10-yr) (Orifice Controls 2.60 cfs @ 9.72 fps)
- 3=Control Orifice (25-yr) (Orifice Controls 0.15 cfs @ 1.21 fps)
- 4=Overflow Orifice (Controls 0.00 cfs)

Pond DC1: Detention Chamber



Summary for Pond DSCB-1: Deep Sump Catch Basin

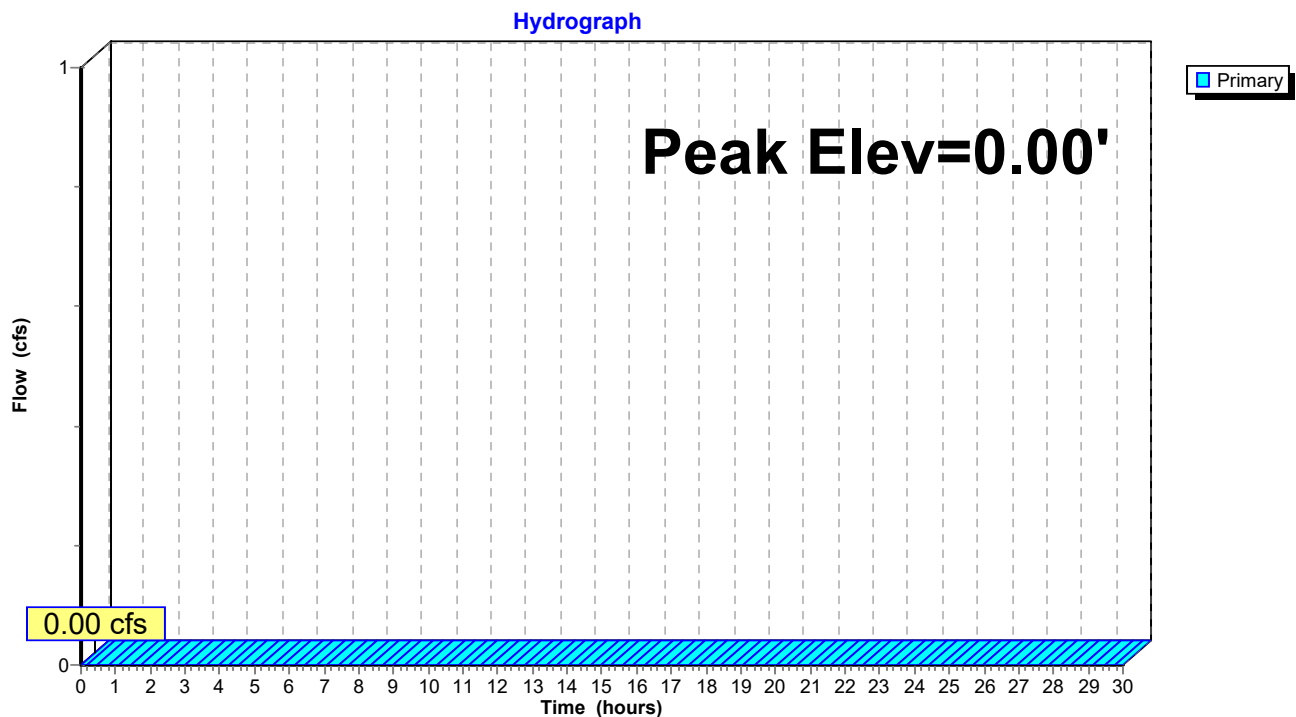
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round Hooded RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 1' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

1=Hooded RCP Culvert (SD-3) (Controls 0.00 cfs)

2=Neenah R1878-A6G Grate (Controls 0.00 cfs)

Pond DSCB-1: Deep Sump Catch Basin



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Summary for Pond GAP: Area Drain

Inflow Area = 0.034 ac, 62.61% Impervious, Inflow Depth = 5.94" for 25-Year event
 Inflow = 0.22 cfs @ 12.13 hrs, Volume= 0.017 af
 Outflow = 0.22 cfs @ 12.13 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.1 min
 Primary = 0.22 cfs @ 12.13 hrs, Volume= 0.017 af
 Routed to Pond DC1 : Detention Chamber

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 54.50' @ 12.13 hrs Storage= 0 cf

Flood Elev= 55.00' Storage= 112 cf

Plug-Flow detention time= 0.0 min calculated for 0.017 af (100% of inflow)

Center-of-Mass det. time= 0.0 min (754.5 - 754.5)

Volume	Invert	Avail.Storage	Storage Description
#1	54.50'	2,068 cf	Open Area (Prismatic) Listed below -Impervious

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.50	559	0.0	0	0
55.00	559	40.0	112	112
58.50	559	100.0	1,957	2,068

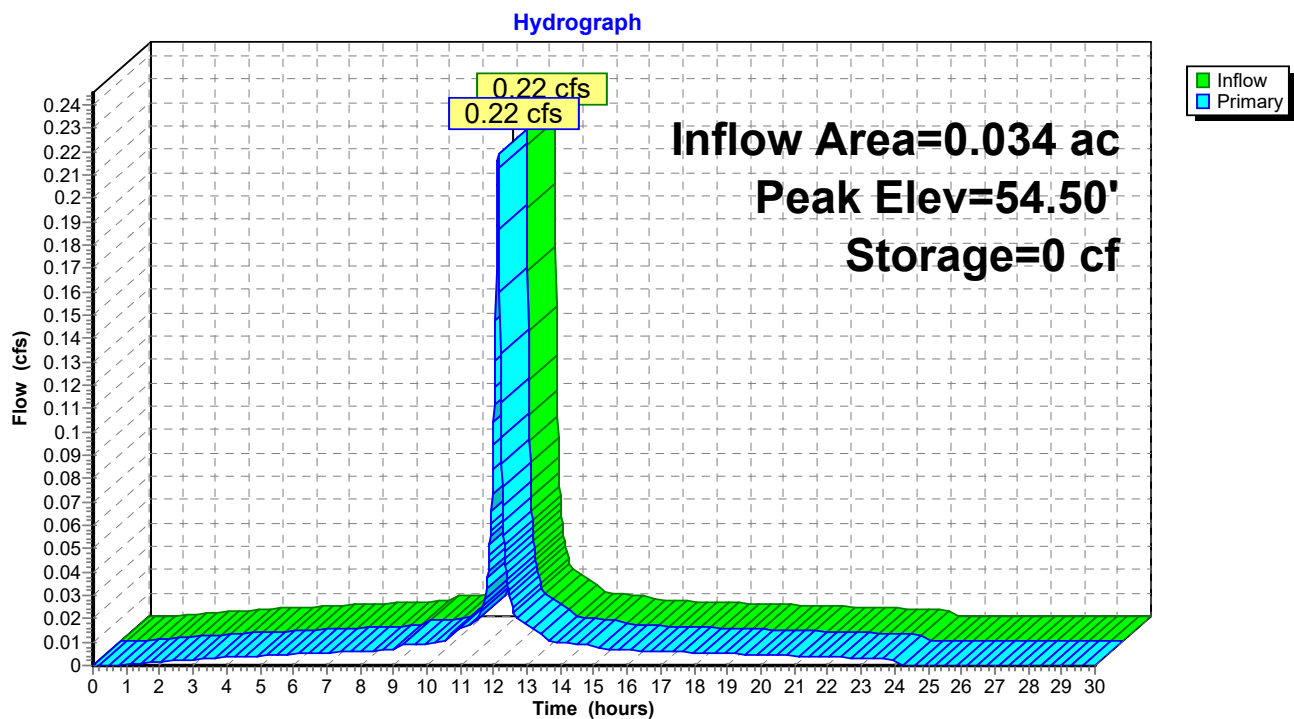
Device	Routing	Invert	Outlet Devices
#1	Primary	26.00'	6.00" Round Ductile Iron Drain Pipe (SD-4) L= 27.6' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.00' / 25.00' S= 0.0362 ' / ' Cc= 0.900 n= 0.014 Steel, smooth, Flow Area= 0.20 sf
#2	Device 1	54.50'	2.00" x 2.00" Horiz. Neenah R-3203-A Inlet Grate X 6.00 columns X 6 rows C= 0.600 in 20.00" x 20.00" Grate (36% open area)

Primary OutFlow Max=0.22 cfs @ 12.13 hrs HW=54.50' TW=26.38' (Dynamic Tailwater)

1=Ductile Iron Drain Pipe (SD-4) (Passes 0.22 cfs of 4.16 cfs potential flow)

2=Neenah R-3203-A Inlet Grate (Orifice Controls 0.22 cfs @ 0.22 fps)

Pond GAP: Area Drain



Summary for Pond IC1: Infiltration Chamber Under Garage

Volume	Invert	Avail.Storage	Storage Description
#1A	22.73'	450 cf	50.00'W x 16.00'L x 6.17'H Field A 4,936 cf Overall - 3,810 cf Embedded = 1,126 cf x 40.0% Voids
#2A	23.23'	3,000 cf	Shea Leaching Chamber 8x14x5.7 x 6 Inside #1 Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf 6 Chambers in 6 Rows
		3,450 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.73'	25.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 15.00' Phase-In= 0.08'
#2	Primary	24.55'	12.00" Round RCP Culvert (SD-1) L= 70.7' Ke= 1.800 Inlet / Outlet Invert= 24.55' / 24.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	24.55'	4.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	27.60'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)↑ **1=Exfiltration** (Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)↑ **2=RCP Culvert (SD-1)** (Controls 0.00 cfs)↑ **3=Control Orifice** (Controls 0.00 cfs)↑ **4=Overflow Orifice** (Controls 0.00 cfs)

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Pond IC1: Infiltration Chamber Under Garage - Chamber Wizard Field A

Chamber Model = Shea Leaching Chamber 8x14x5.7 (Shea Galley)

Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf

Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf

1 Chambers/Row x 14.00' Long = 14.00' Row Length +12.0" End Stone x 2 = 16.00' Base Length

6 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 50.00' Base Width

6.0" Stone Base + 68.0" Chamber Height = 6.17' Field Height

6 Chambers x 500.0 cf = 3,000.0 cf Chamber Storage

6 Chambers x 635.0 cf = 3,810.2 cf Displacement

4,936.0 cf Field - 3,810.2 cf Chambers = 1,125.8 cf Stone x 40.0% Voids = 450.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,450.3 cf = 0.079 af

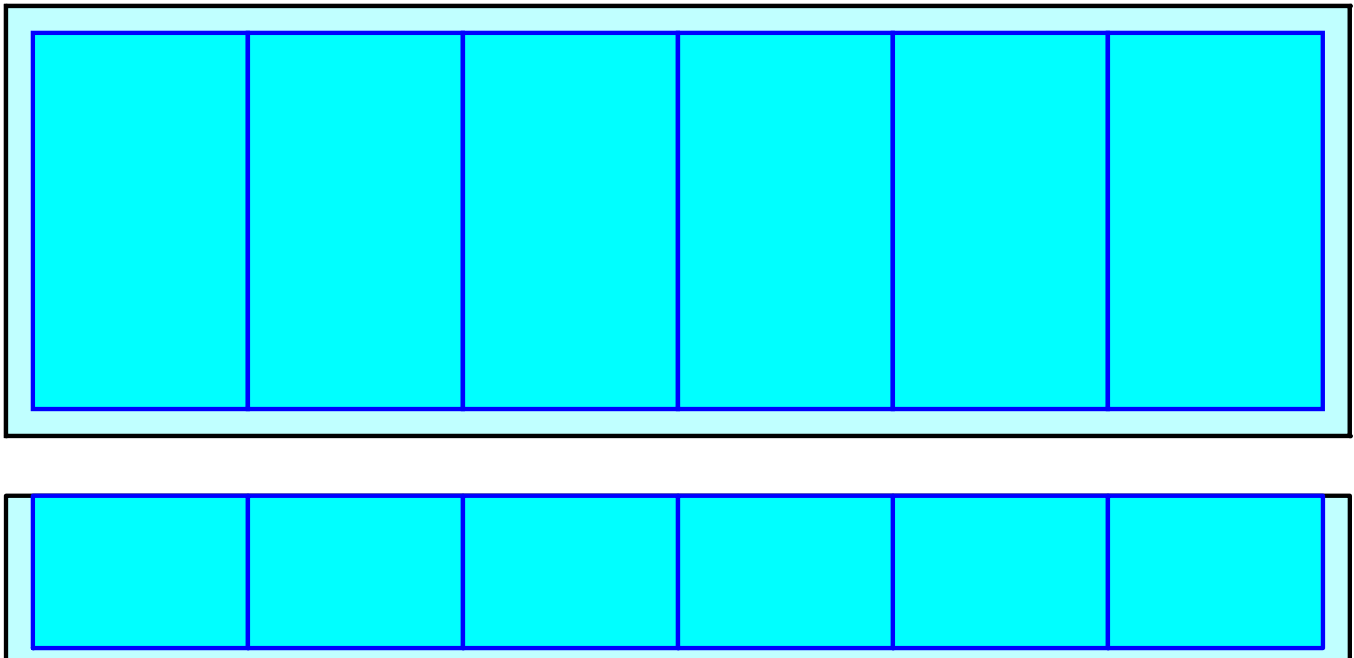
Overall Storage Efficiency = 69.9%

Overall System Size = 16.00' x 50.00' x 6.17'

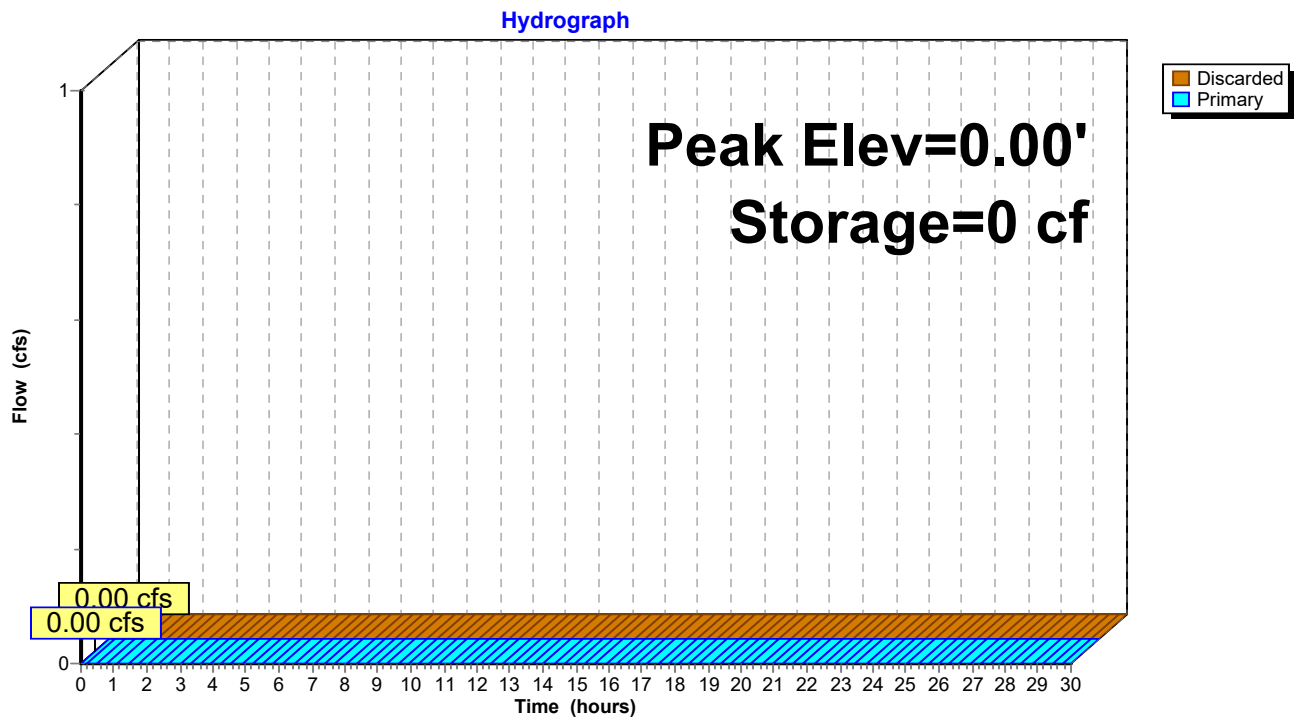
6 Chambers

182.8 cy Field

41.7 cy Stone



Pond IC1: Infiltration Chamber Under Garage



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Summary for Pond IC2: Infiltration Chamber Under Parking Lot

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 5.59" for 25-Year event
 Inflow = 1.77 cfs @ 12.13 hrs, Volume= 0.132 af
 Outflow = 1.47 cfs @ 12.17 hrs, Volume= 0.132 af, Atten= 17%, Lag= 2.3 min
 Discarded = 0.07 cfs @ 12.17 hrs, Volume= 0.086 af
 Primary = 1.40 cfs @ 12.17 hrs, Volume= 0.046 af
 Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 50.30' @ 12.17 hrs Surf.Area= 540 sf Storage= 858 cf

Plug-Flow detention time= 43.9 min calculated for 0.132 af (100% of inflow)
 Center-of-Mass det. time= 43.9 min (818.2 - 774.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	48.08'	206 cf	18.00'W x 30.00'L x 3.17'H Field A 1,712 cf Overall - 1,196 cf Embedded = 516 cf x 40.0% Voids
#2A	48.58'	800 cf	Shea Leaching Chamber 8x14x2.7 x 4 Inside #1 Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf 4 Chambers in 2 Rows
		1,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.08'	4.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 17.50' Phase-In= 0.08'
#2	Primary	49.33'	12.00" Round RCP Culvert (SD-2) L= 53.0' Ke= 1.800 Inlet / Outlet Invert= 49.33' / 48.00' S= 0.0251 ' /' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	49.33'	9.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	50.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.07 cfs @ 12.17 hrs HW=50.30' (Free Discharge)
 ↳ **1=Exfiltration** (Controls 0.07 cfs)

Primary OutFlow Max=1.39 cfs @ 12.17 hrs HW=50.30' TW=0.00' (Dynamic Tailwater)
 ↳ **2=RCP Culvert (SD-2)** (Inlet Controls 1.39 cfs @ 1.79 fps)
 ↳ **3=Control Orifice** (Passes < 1.63 cfs potential flow)
 ↳ **4=Overflow Orifice** (Passes < 0.10 cfs potential flow)

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Pond IC2: Infiltration Chamber Under Parking Lot - Chamber Wizard Field A

Chamber Model = Shea Leaching Chamber 8x14x2.7 (Shea Galley)

Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf

Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf

2 Chambers/Row x 14.00' Long = 28.00' Row Length +12.0" End Stone x 2 = 30.00' Base Length

2 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 18.00' Base Width

6.0" Stone Base + 32.0" Chamber Height = 3.17' Field Height

4 Chambers x 200.0 cf = 800.0 cf Chamber Storage

4 Chambers x 299.0 cf = 1,196.2 cf Displacement

1,711.8 cf Field - 1,196.2 cf Chambers = 515.6 cf Stone x 40.0% Voids = 206.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,006.3 cf = 0.023 af

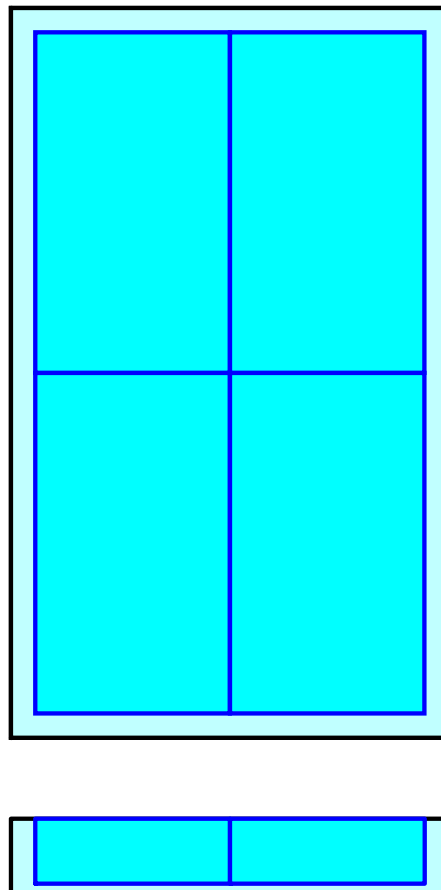
Overall Storage Efficiency = 58.8%

Overall System Size = 30.00' x 18.00' x 3.17'

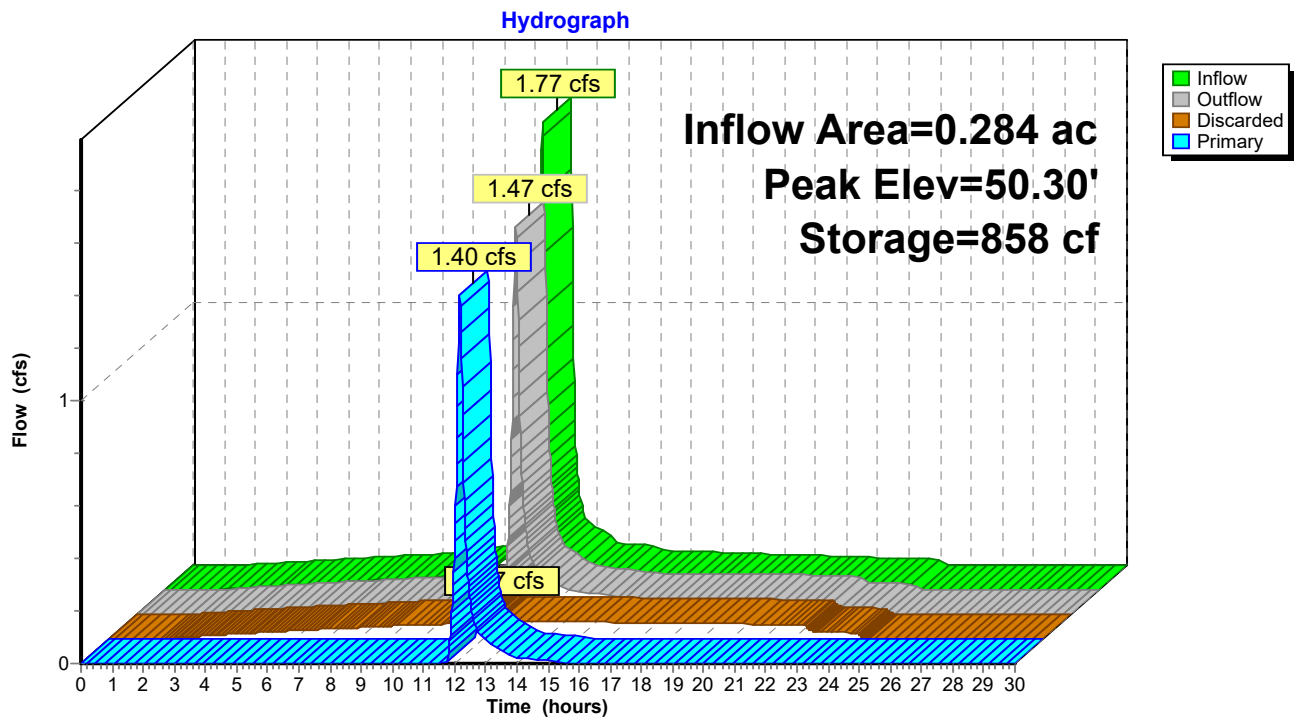
4 Chambers

63.4 cy Field

19.1 cy Stone



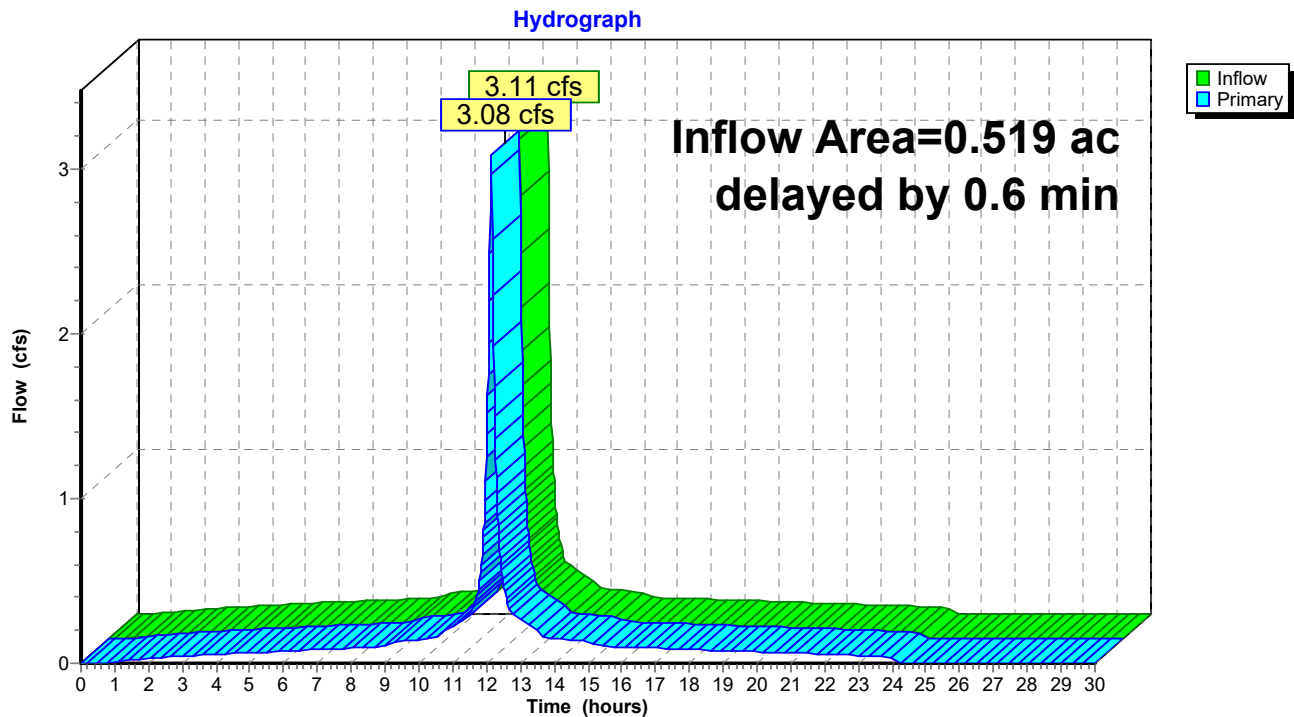
Pond IC2: Infiltration Chamber Under Parking Lot



Summary for Link DP1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.519 ac, 98.58% Impervious, Inflow Depth = 5.97" for 25-Year event
Inflow = 3.11 cfs @ 12.13 hrs, Volume= 0.258 af
Primary = 3.08 cfs @ 12.14 hrs, Volume= 0.258 af, Atten= 1%, Lag= 0.6 min
Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP1: Oakland St. Catch Basin (CB 2)

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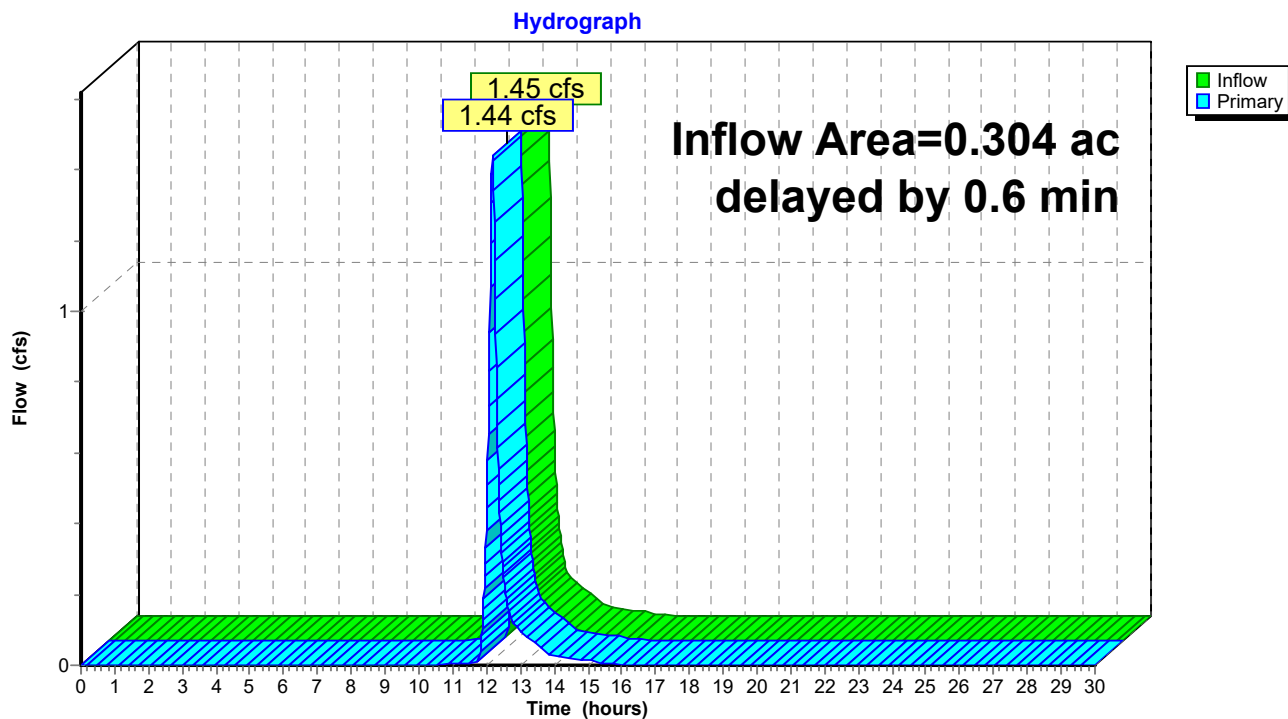
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Summary for Link DP1-1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.304 ac, 81.38% Impervious, Inflow Depth = 2.00" for 25-Year event
Inflow = 1.45 cfs @ 12.16 hrs, Volume= 0.051 af
Primary = 1.44 cfs @ 12.17 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.6 min
Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

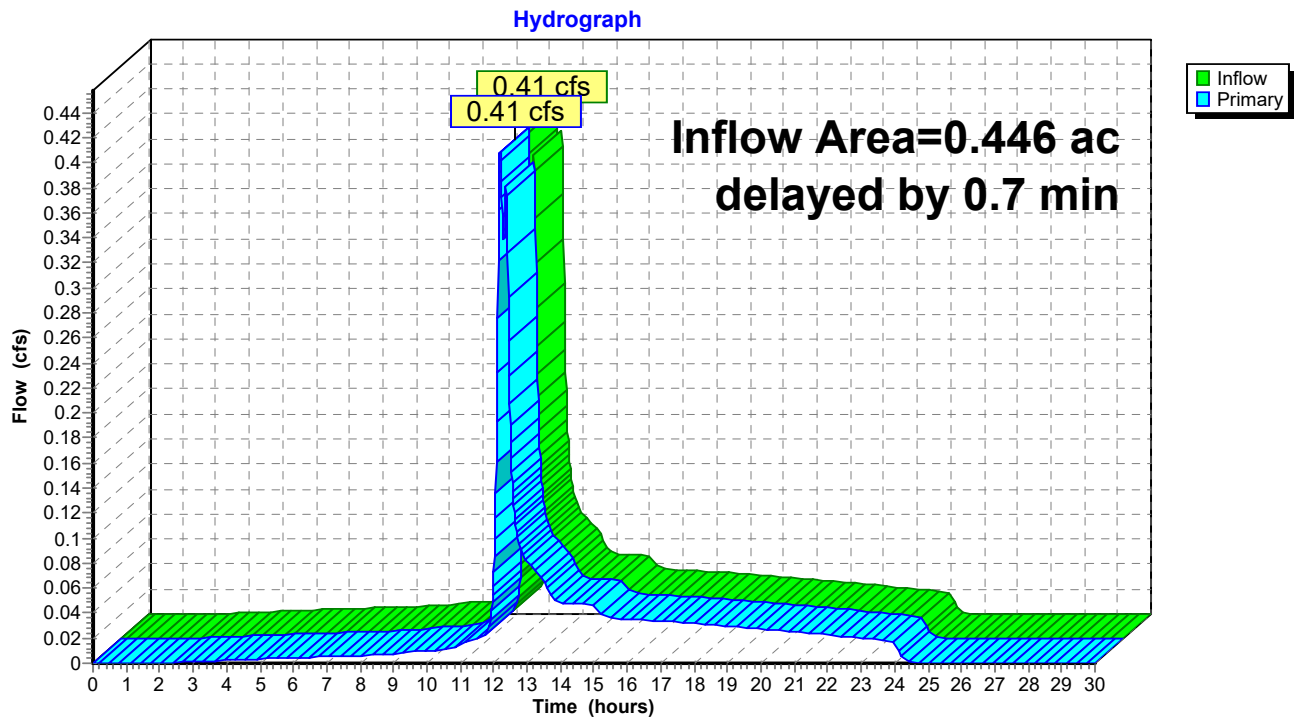
Link DP1-1: Oakland St. Catch Basin (CB 2)



Summary for Link DP2: Overland to City Drain (CB 8) via Lot 97

Inflow Area = 0.446 ac, 30.85% Impervious, Inflow Depth = 1.42" for 25-Year event
Inflow = 0.41 cfs @ 12.18 hrs, Volume= 0.053 af
Primary = 0.41 cfs @ 12.19 hrs, Volume= 0.053 af, Atten= 0%, Lag= 0.7 min
Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

Primary outflow = Inflow delayed by 0.7 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP2: Overland to City Drain (CB 8) via Lot 97

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NOAA10 24-hr D 25-Year Rainfall=6.30"

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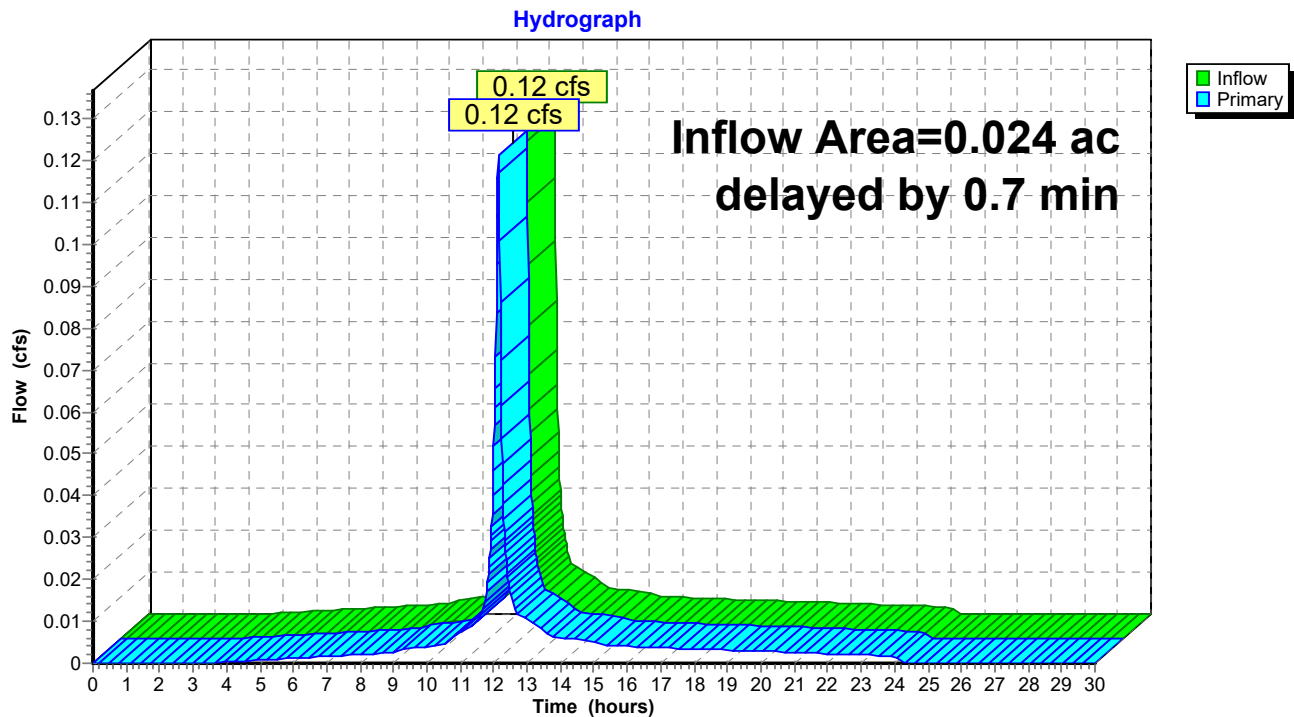
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Summary for Link DP2-1: Overland to City Drain (CB 8) via Lot 97

Inflow Area = 0.024 ac, 0.00% Impervious, Inflow Depth = 4.23" for 25-Year event
Inflow = 0.12 cfs @ 12.13 hrs, Volume= 0.009 af
Primary = 0.12 cfs @ 12.14 hrs, Volume= 0.009 af, Atten= 1%, Lag= 0.7 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Primary outflow = Inflow delayed by 0.7 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

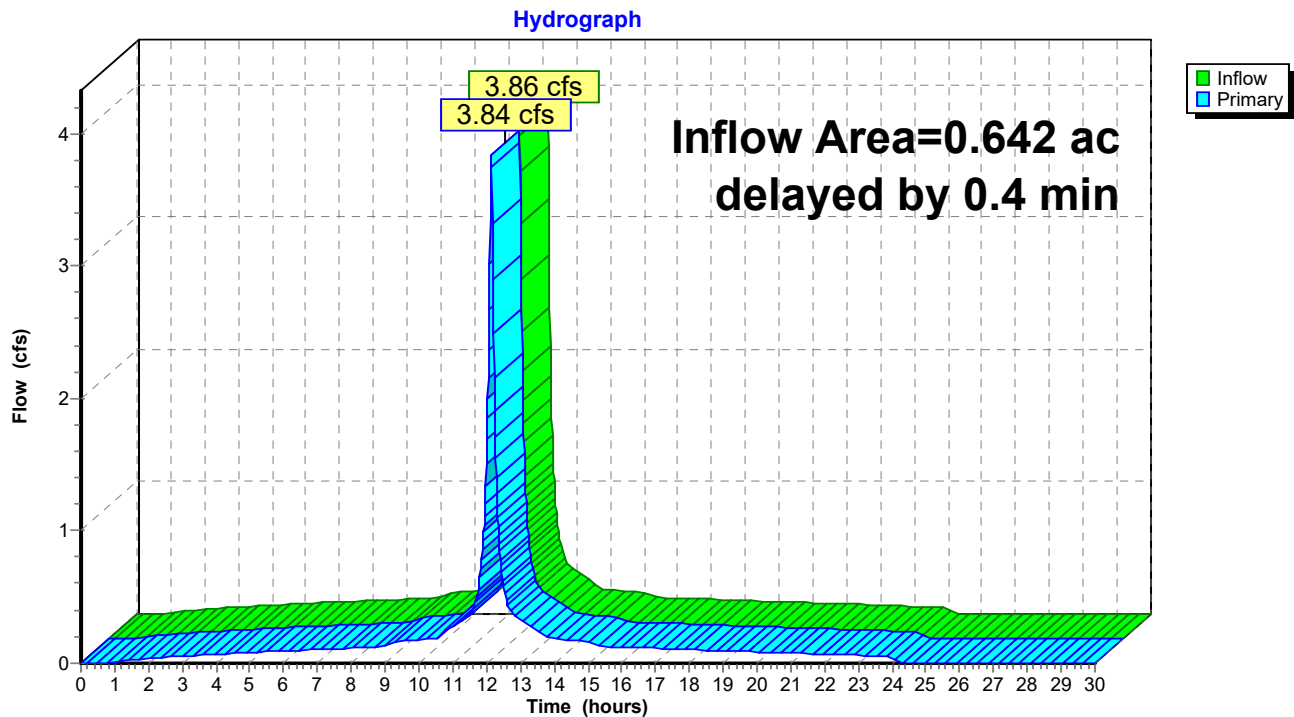
Link DP2-1: Overland to City Drain (CB 8) via Lot 97



Summary for Link DP3: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.642 ac, 98.80% Impervious, Inflow Depth = 5.98" for 25-Year event
Inflow = 3.86 cfs @ 12.14 hrs, Volume= 0.320 af
Primary = 3.84 cfs @ 12.14 hrs, Volume= 0.320 af, Atten= 1%, Lag= 0.4 min
Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3: Chestnut St. Drain Manhole (DMH 3)

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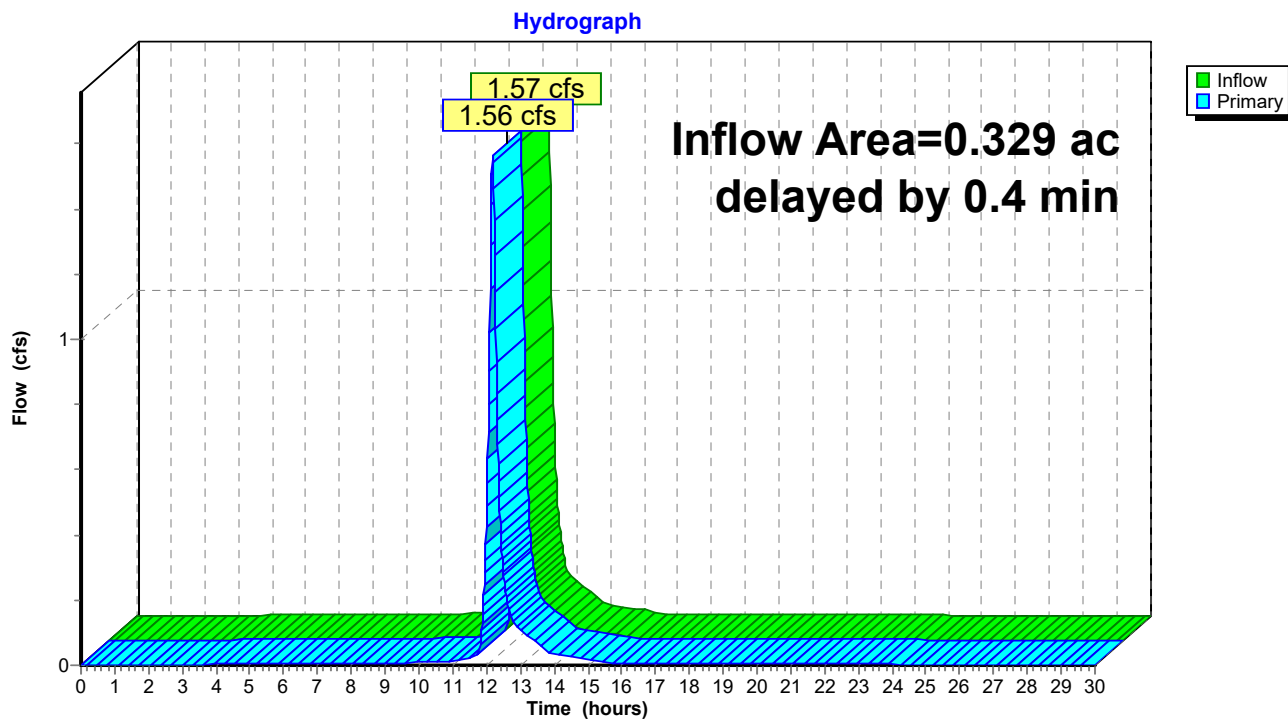
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Summary for Link DP3-1: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.329 ac, 82.42% Impervious, Inflow Depth = 2.30" for 25-Year event
Inflow = 1.57 cfs @ 12.17 hrs, Volume= 0.063 af
Primary = 1.56 cfs @ 12.17 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.4 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3-1: Chestnut St. Drain Manhole (DMH 3)



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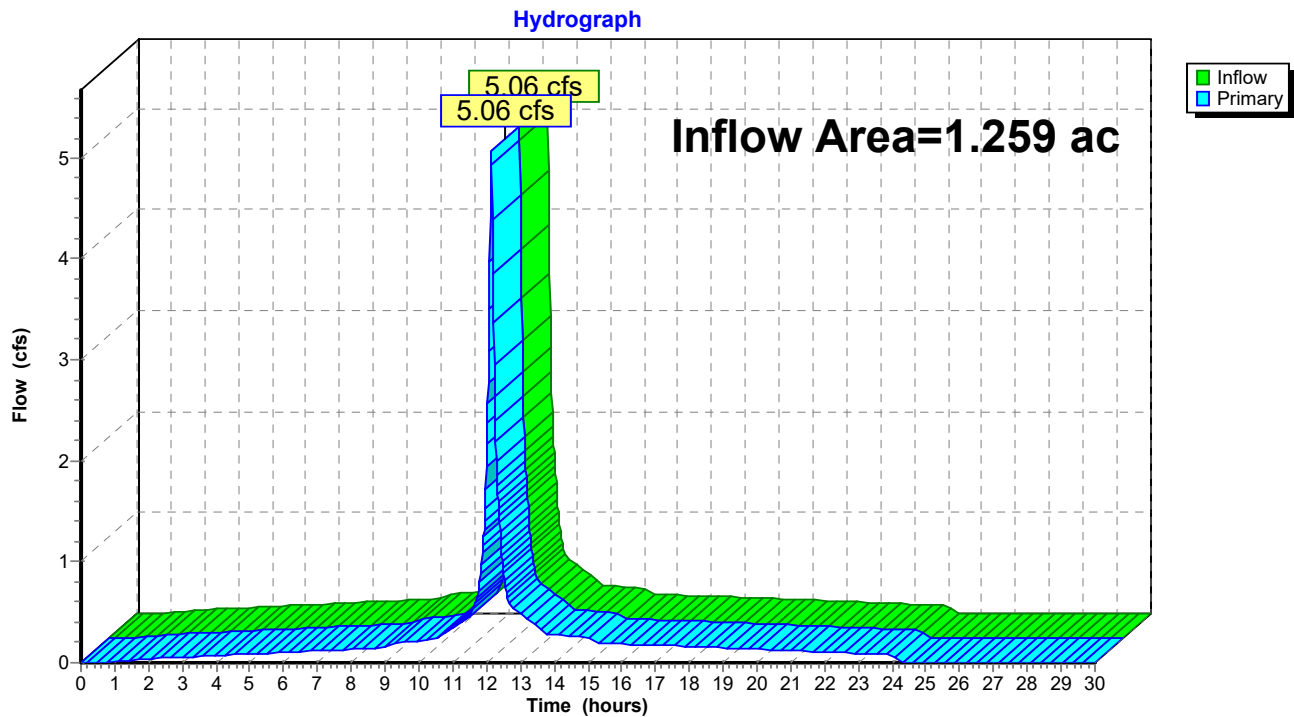
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Summary for Link DP4: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 69.90% Impervious, Inflow Depth = 4.14" for 25-Year event
Inflow = 5.06 cfs @ 12.14 hrs, Volume= 0.434 af
Primary = 5.06 cfs @ 12.14 hrs, Volume= 0.434 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP4: Chestnut St. Drain Manhole (DMH 4)



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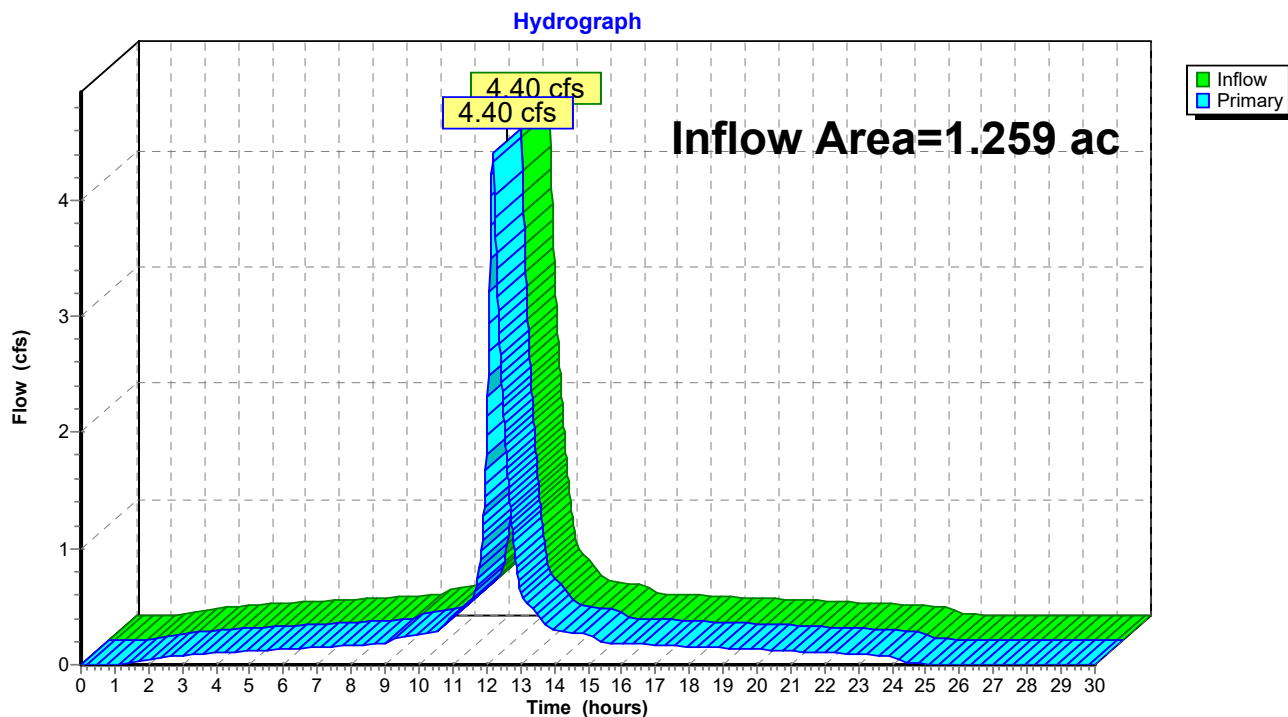
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Summary for Link DP4-1: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 91.44% Impervious, Inflow Depth = 5.01" for 25-Year event
Inflow = 4.40 cfs @ 12.20 hrs, Volume= 0.526 af
Primary = 4.40 cfs @ 12.20 hrs, Volume= 0.526 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP4-1: Chestnut St. Drain Manhole (DMH 4)



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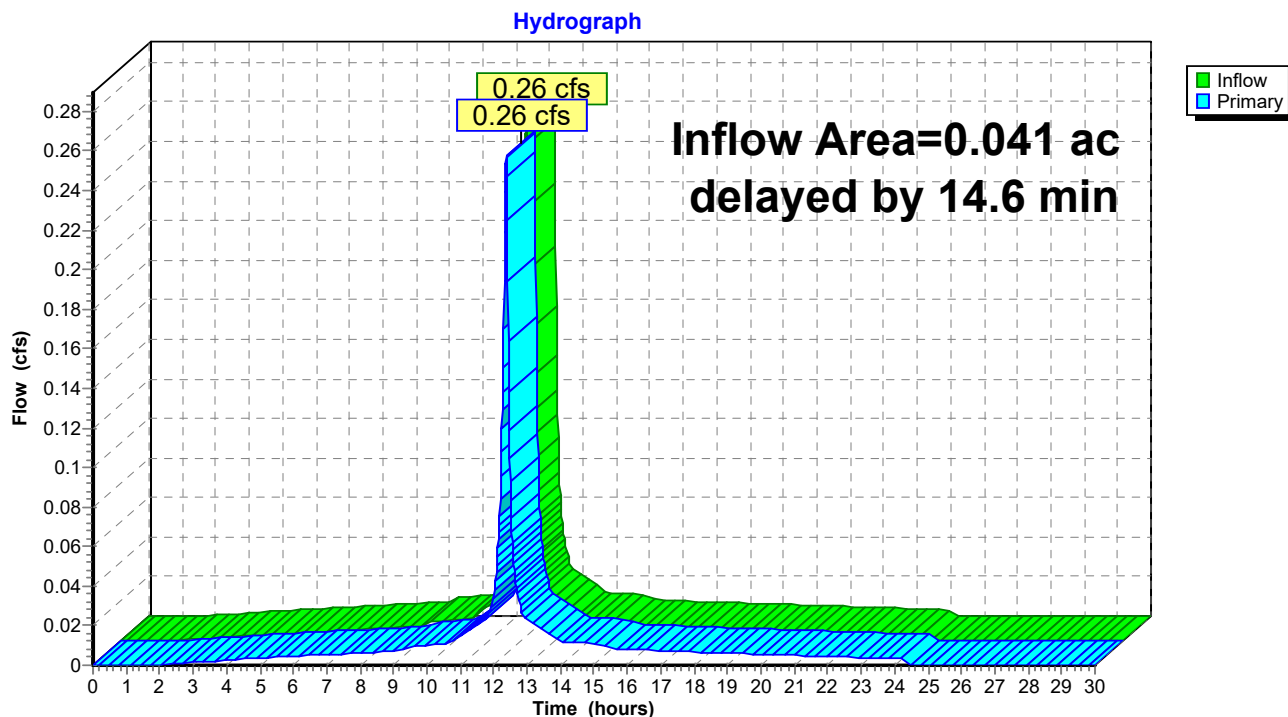
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Summary for Link L2: Lag Time for Flow from S2B to DP2

Inflow Area = 0.041 ac, 93.46% Impervious, Inflow Depth = 5.59" for 25-Year event
Inflow = 0.26 cfs @ 12.13 hrs, Volume= 0.019 af
Primary = 0.26 cfs @ 12.37 hrs, Volume= 0.019 af, Atten= 0%, Lag= 14.6 min
Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 14.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link L2: Lag Time for Flow from S2B to DP2

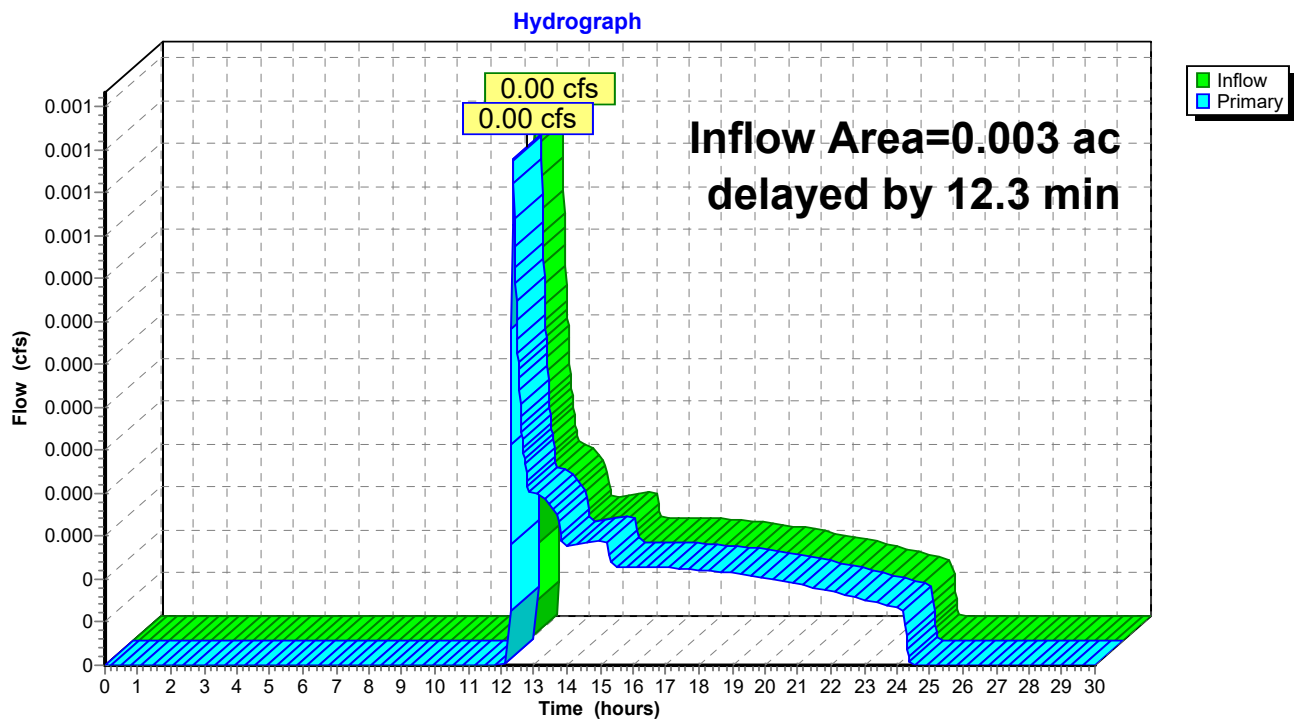


Summary for Link L2-1: Lag Time for Flow from S2B-1 to DP2-1

Inflow Area = 0.003 ac, 0.00% Impervious, Inflow Depth = 0.53" for 25-Year event
 Inflow = 0.00 cfs @ 12.17 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 12.37 hrs, Volume= 0.000 af, Atten= 1%, Lag= 12.3 min
 Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 12.3 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link L2-1: Lag Time for Flow from S2B-1 to DP2-1



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Summary for Subcatchment S1: Parking & Front of Buildings

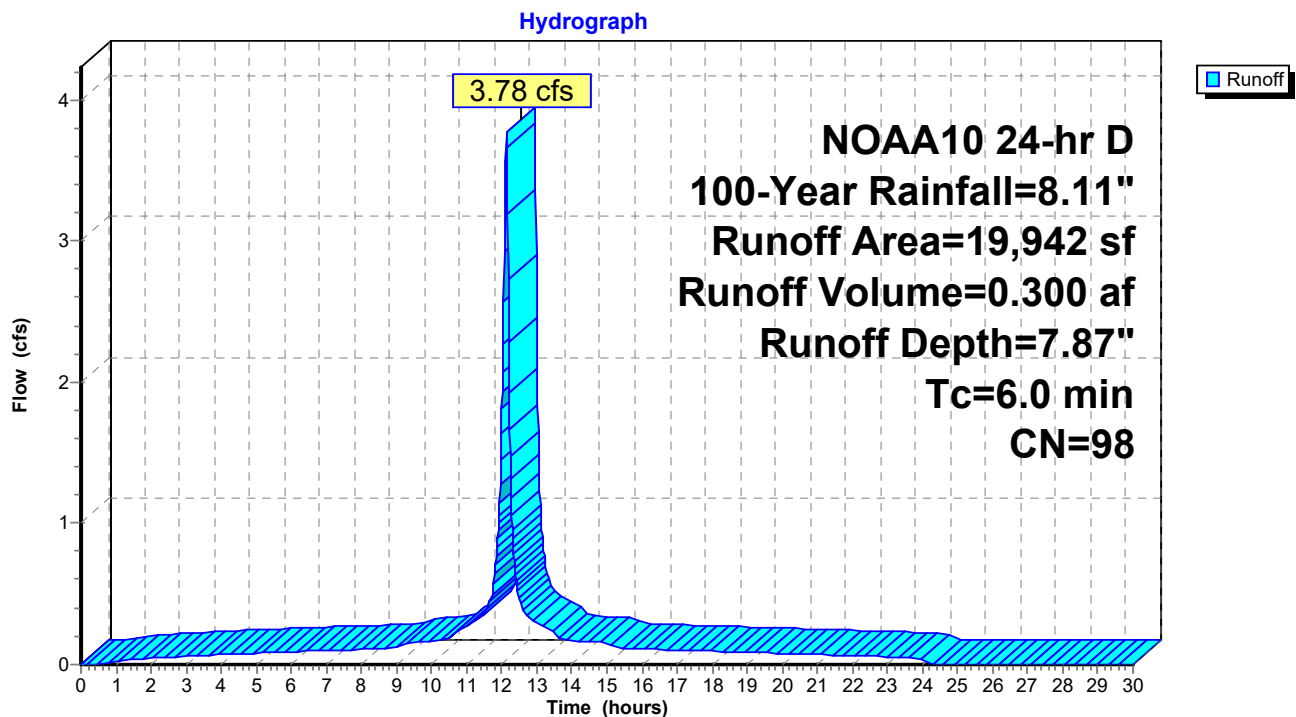
Runoff = 3.78 cfs @ 12.13 hrs, Volume= 0.300 af, Depth= 7.87"

Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
12,479	98	Paved parking, HSG A
7,463	98	Roofs, HSG A
19,942	98	Weighted Average
19,942		100.00% Impervious Area

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

Subcatchment S1: Parking & Front of Buildings

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Summary for Subcatchment S1-1: Drains to Parking Lot Chambers

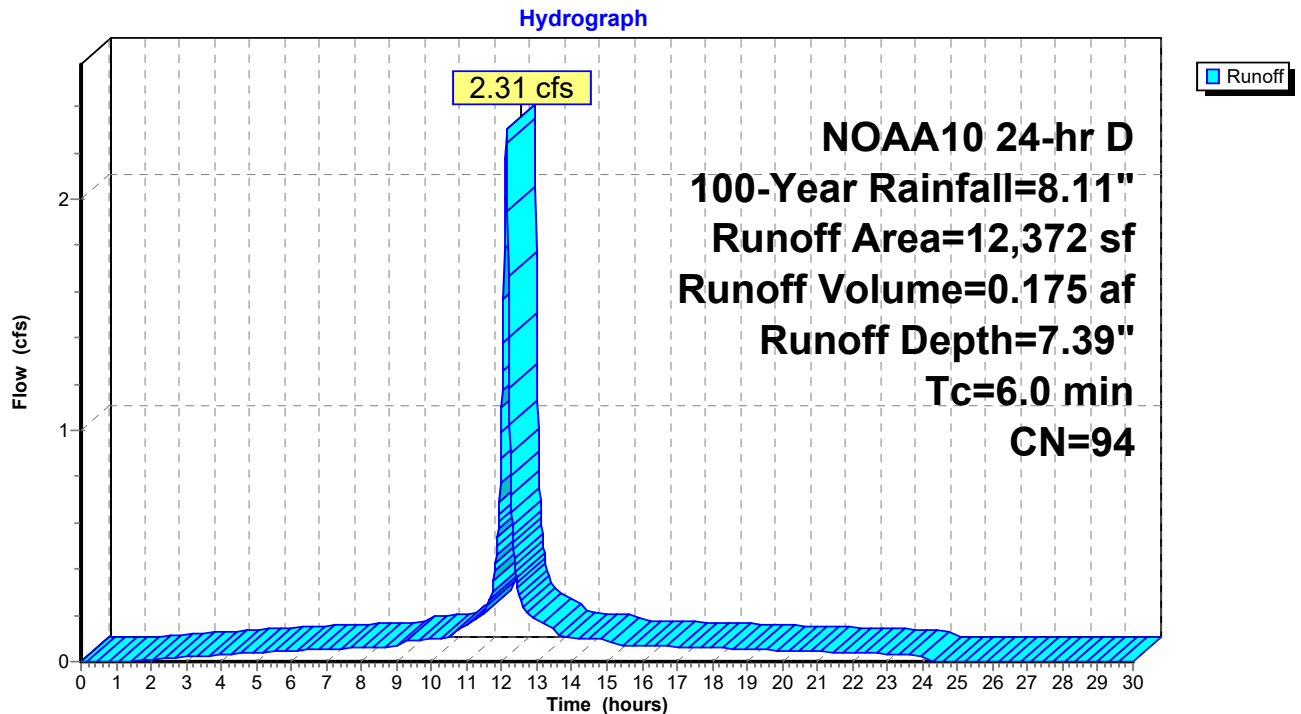
Runoff = 2.31 cfs @ 12.13 hrs, Volume= 0.175 af, Depth= 7.39"

Routed to Pond CDS1 : Water Quality Catch Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
717	39	>75% Grass cover, Good, HSG A
1,237	96	Gravel surface, HSG A
10,418	98	Paved parking, HSG A
12,372	94	Weighted Average
1,954		15.79% Pervious Area
10,418		84.21% Impervious Area

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

Subcatchment S1-1: Drains to Parking Lot Chambers

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Summary for Subcatchment S1-2: Untreated Runoff onto Oakland St.

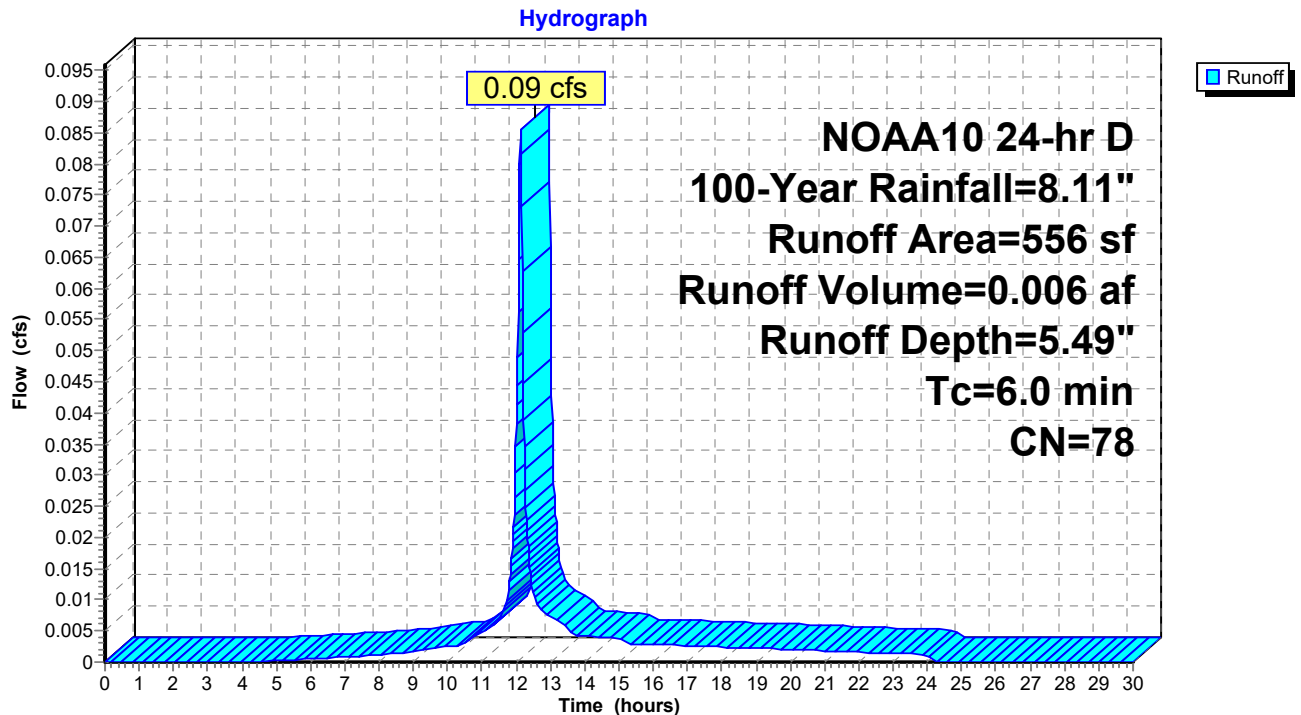
Runoff = 0.09 cfs @ 12.13 hrs, Volume= 0.006 af, Depth= 5.49"

Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
191	39	>75% Grass cover, Good, HSG A
365	98	Paved parking, HSG A
556	78	Weighted Average
191		34.35% Pervious Area
365		65.65% Impervious Area

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

Subcatchment S1-2: Untreated Runoff onto Oakland St.

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Summary for Subcatchment S2A: Easterly Roof & Lot Line

Runoff = 0.33 cfs @ 12.24 hrs, Volume= 0.036 af, Depth= 7.03"

Routed to Link DP1 : Oakland St. Catch Basin (CB 2)

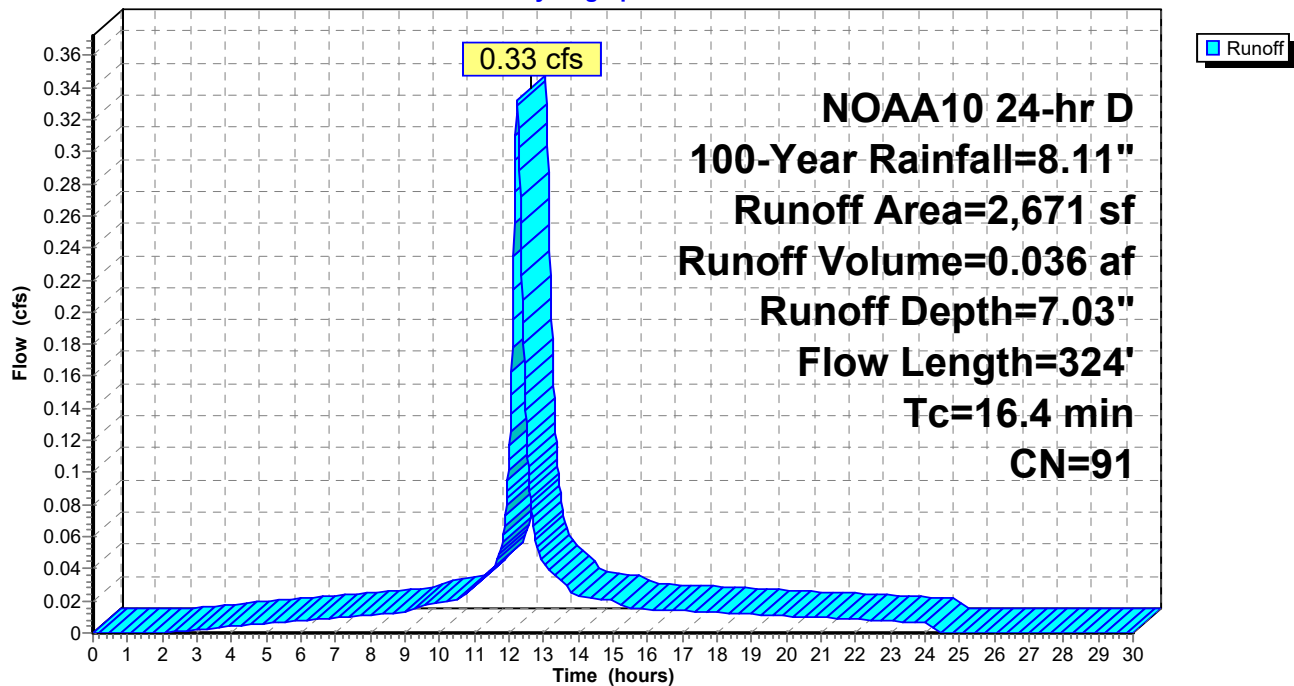
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
322	39	>75% Grass cover, Good, HSG A
2,349	98	Unconnected roofs, HSG A
2,671	91	Weighted Average
322		12.06% Pervious Area
2,349		87.94% Impervious Area
2,349		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A: Easterly Roof & Lot Line

Hydrograph



Summary for Subcatchment S2A-1: Easterly Lot Line

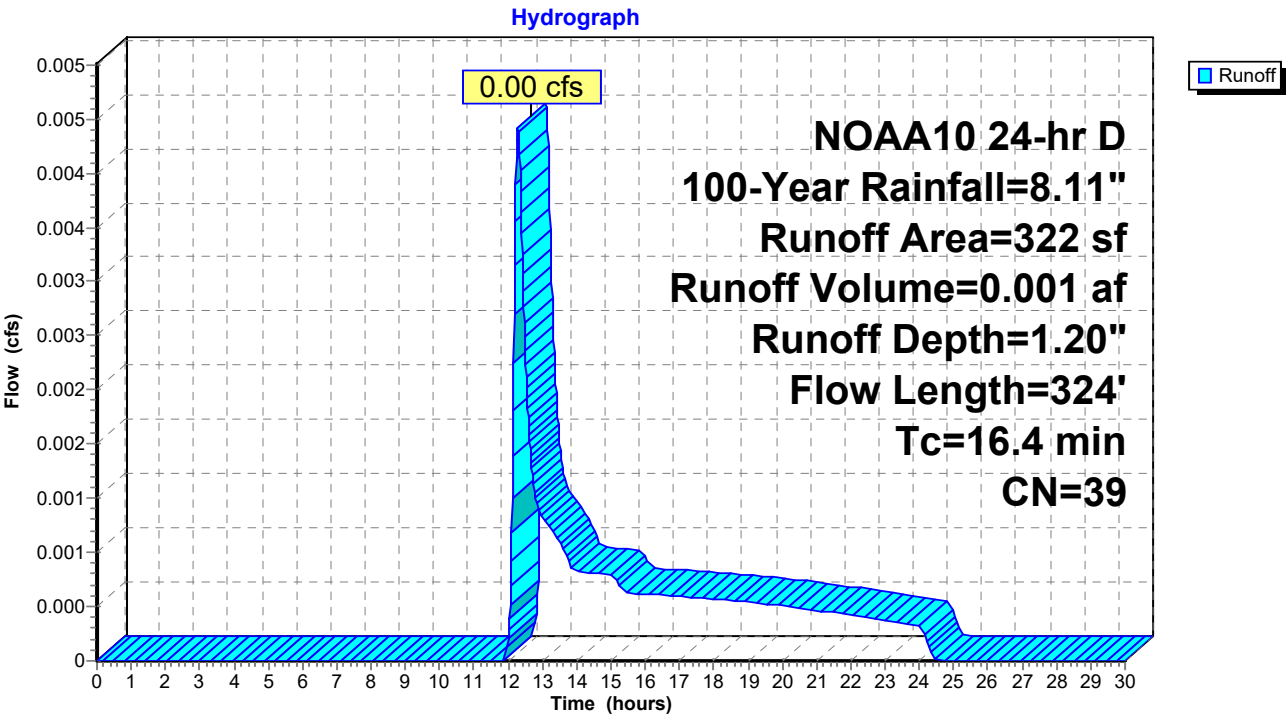
Runoff = 0.00 cfs @ 12.28 hrs, Volume= 0.001 af, Depth= 1.20"
Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description			
322	39	>75% Grass cover, Good, HSG A			
322		100.00% Pervious Area			

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.7	83	0.0059	0.10		Sheet Flow, Lawn Grass: Short n= 0.150 P2= 3.24"
2.7	241	0.0159	1.51		Sheet Flow, Oakland St. Gutter Smooth surfaces n= 0.011 P2= 3.24"
16.4	324	Total			

Subcatchment S2A-1: Easterly Lot Line



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Summary for Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

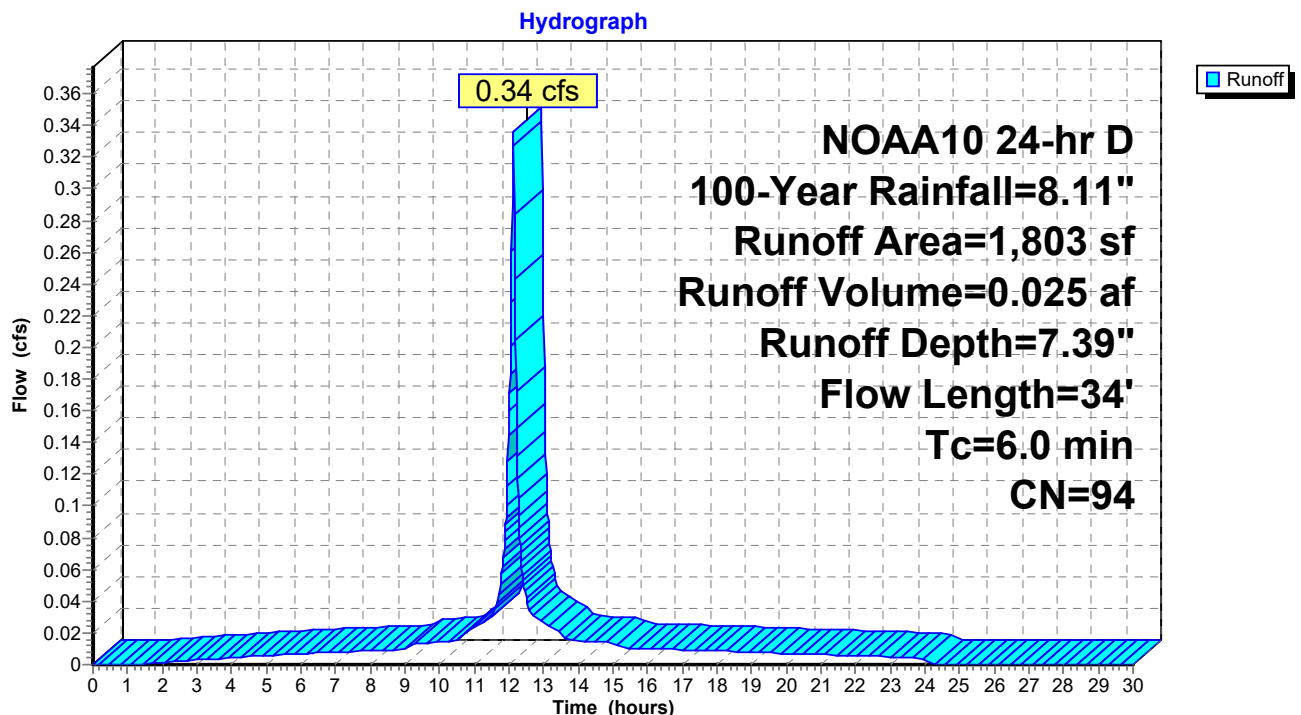
Runoff = 0.34 cfs @ 12.13 hrs, Volume= 0.025 af, Depth= 7.39"

Routed to Link L2 : Lag Time for Flow from S2B to DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
1,685	98	Unconnected roofs, HSG A
1,803	94	Weighted Average
118		6.54% Pervious Area
1,685		93.46% Impervious Area
1,685		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	34		0.09		Direct Entry, Assumed Minimum

Subcatchment S2B: Easterly Roof & Lot Line/Flow onto Lot 214

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Summary for Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214

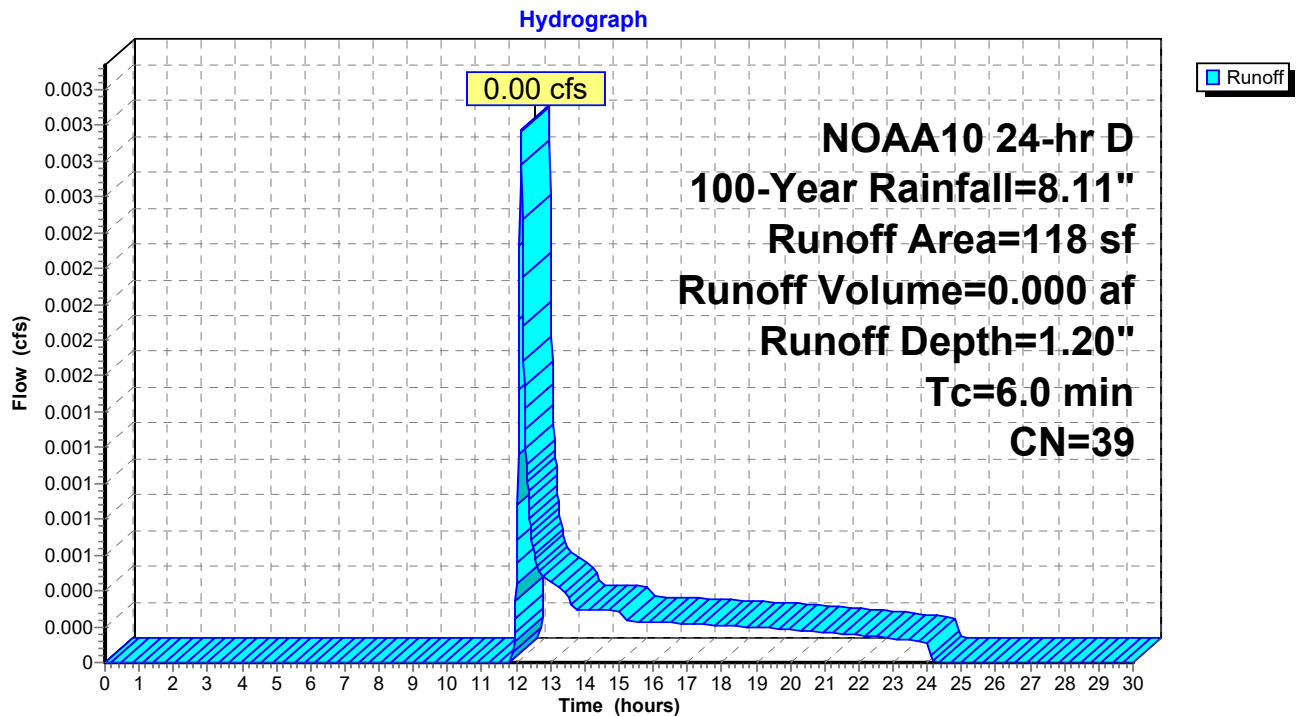
Runoff = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af, Depth= 1.20"

Routed to Link L2-1 : Lag Time for Flow from S2B-1 to DP2-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
118	39	>75% Grass cover, Good, HSG A
118		100.00% Pervious Area

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

Subcatchment S2B-1: Easterly Lot Line/Flow onto Lot 214

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Summary for Subcatchment S2C: Rear of Building & Site (SW)

Runoff = 0.78 cfs @ 12.16 hrs, Volume= 0.064 af, Depth= 1.90"

Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

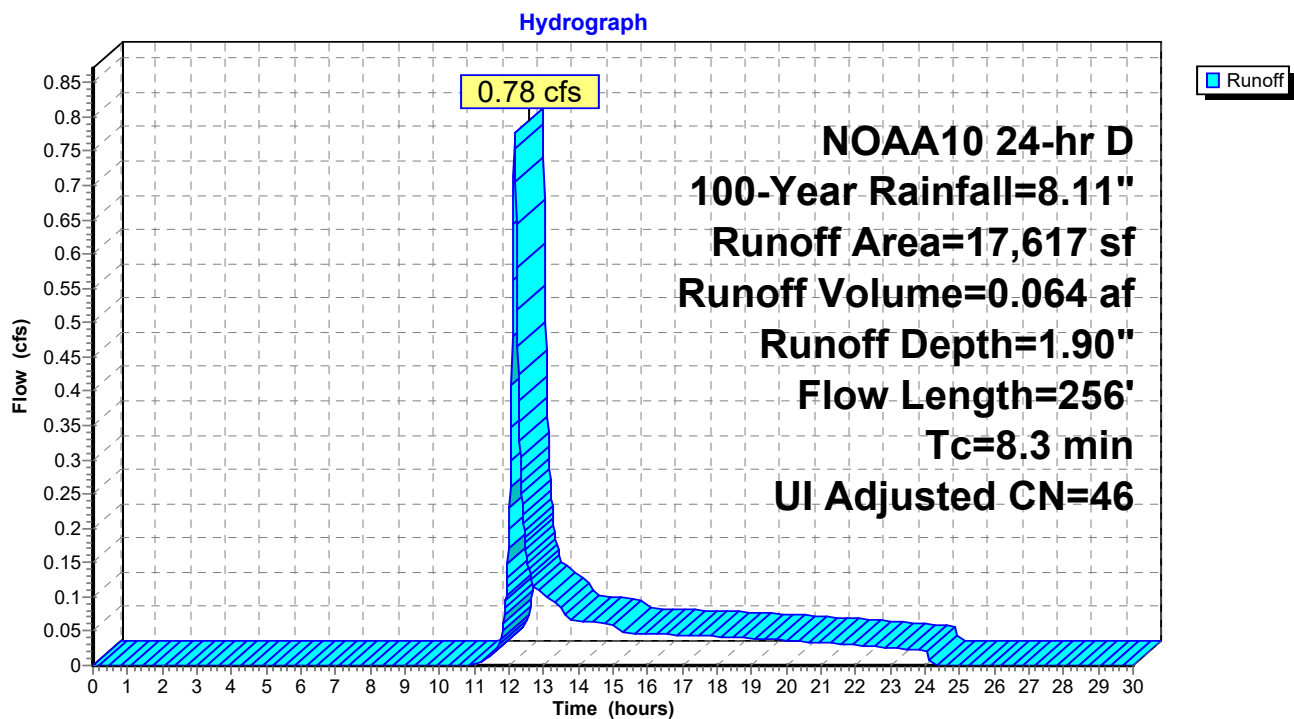
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Adj	Description
1,157	39		>75% Grass cover, Good, HSG A
80	98		Paved parking, HSG A
4,226	98		Unconnected roofs, HSG A
2,147	77		Fallow, bare soil, HSG A
10,007	30		Woods, Good, HSG A
17,617	53	46	Weighted Average, UI Adjusted
13,311			75.56% Pervious Area
4,306			24.44% Impervious Area
4,226			98.14% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	53	0.4720	0.24		Sheet Flow, Wooded Slope Woods: Light underbrush n= 0.400 P2= 3.24"
4.5	177	0.0169	0.65		Shallow Concentrated Flow, Wooded Swale Woodland Kv= 5.0 fps
0.2	26	0.0169	1.95		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
8.3	256	Total			

Subcatchment S2C: Rear of Building & Site (SW)



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Summary for Subcatchment S2C-1: Perimeter of Garage

Runoff = 0.16 cfs @ 12.13 hrs, Volume= 0.012 af, Depth= 6.44"

Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

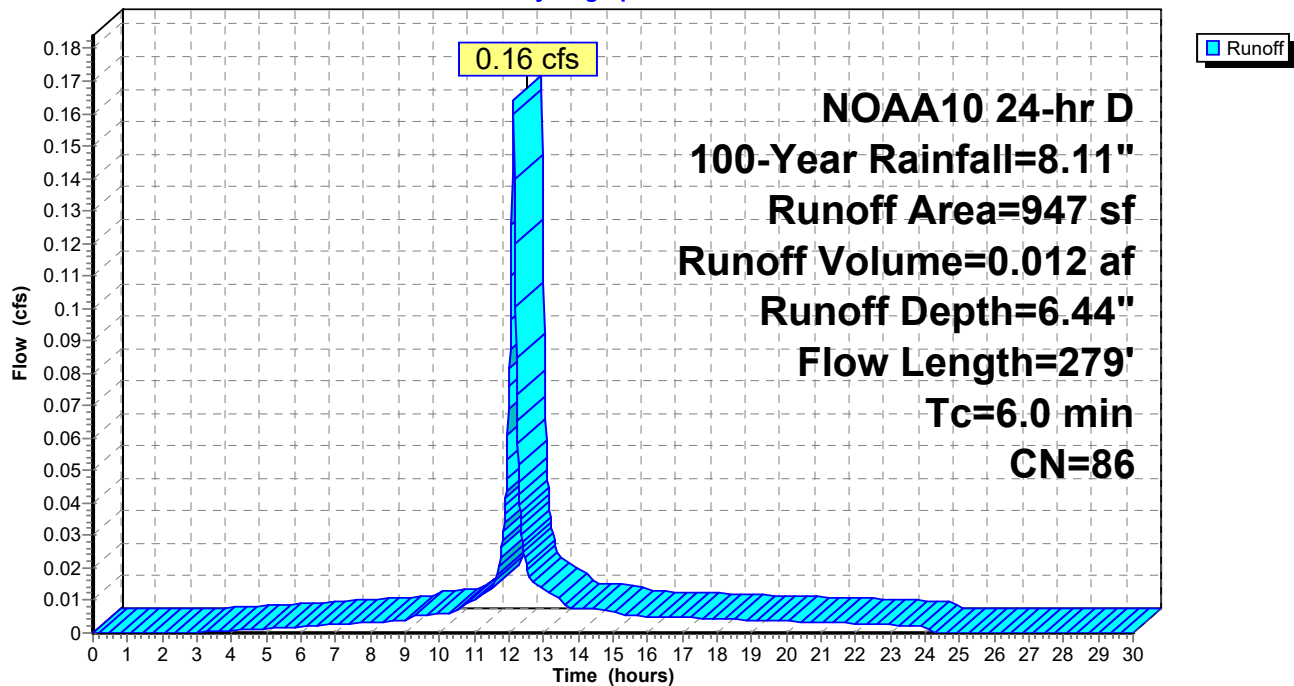
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
167	39	>75% Grass cover, Good, HSG A
780	96	Gravel surface, HSG A
947	86	Weighted Average
947		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.1	51	0.0451	0.21		Sheet Flow, Grassed Slope Grass: Short n= 0.150 P2= 3.24"
1.5	205	0.0195	2.25		Shallow Concentrated Flow, Stone Dust Walkway Unpaved Kv= 16.1 fps
0.3	23	0.0098	1.48		Shallow Concentrated Flow, Lawn Grassed Waterway Kv= 15.0 fps
5.9	279	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S2C-1: Perimeter of Garage

Hydrograph



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Summary for Subcatchment S3: Corner of Oakland & Chestnut (NE)

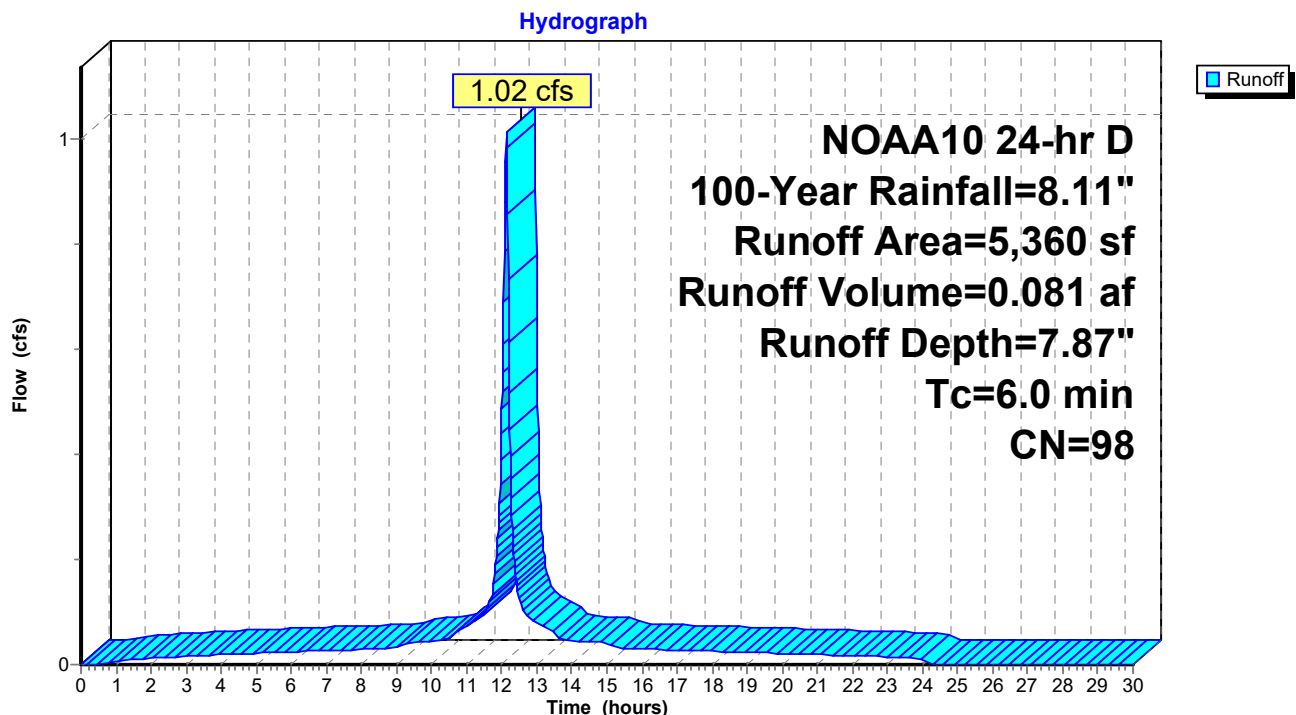
Runoff = 1.02 cfs @ 12.13 hrs, Volume= 0.081 af, Depth= 7.87"

Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
14	39	>75% Grass cover, Good, HSG A
1,053	98	Paved parking, HSG A
4,293	98	Roofs, HSG A
5,360	98	Weighted Average
14		0.26% Pervious Area
5,346		99.74% Impervious Area

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

Subcatchment S3: Corner of Oakland & Chestnut (NE)

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Summary for Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

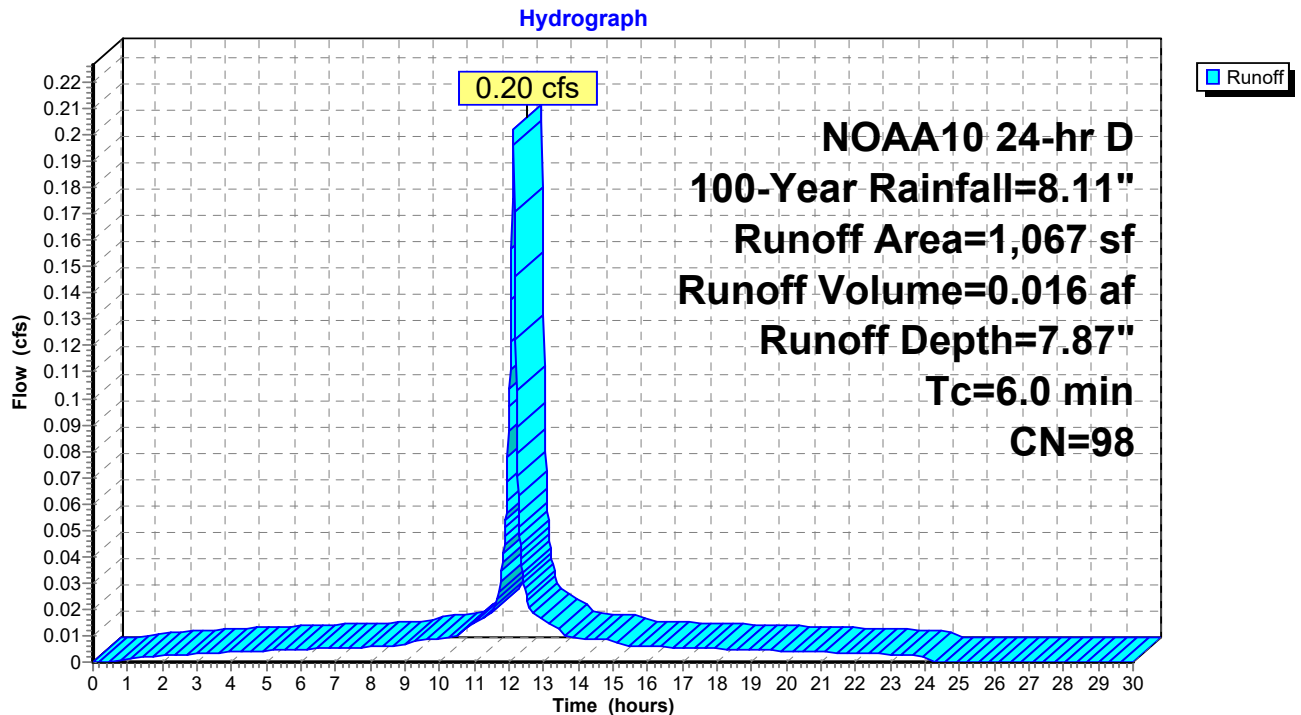
Runoff = 0.20 cfs @ 12.13 hrs, Volume= 0.016 af, Depth= 7.87"

Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
50	96	Gravel surface, HSG A
1,017	98	Paved parking, HSG A
1,067	98	Weighted Average
50		4.69% Pervious Area
1,017		95.31% Impervious Area

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

Subcatchment S3-1: Corner of Oakland & Chestnut (NE)

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Summary for Subcatchment S4: Loading Dock

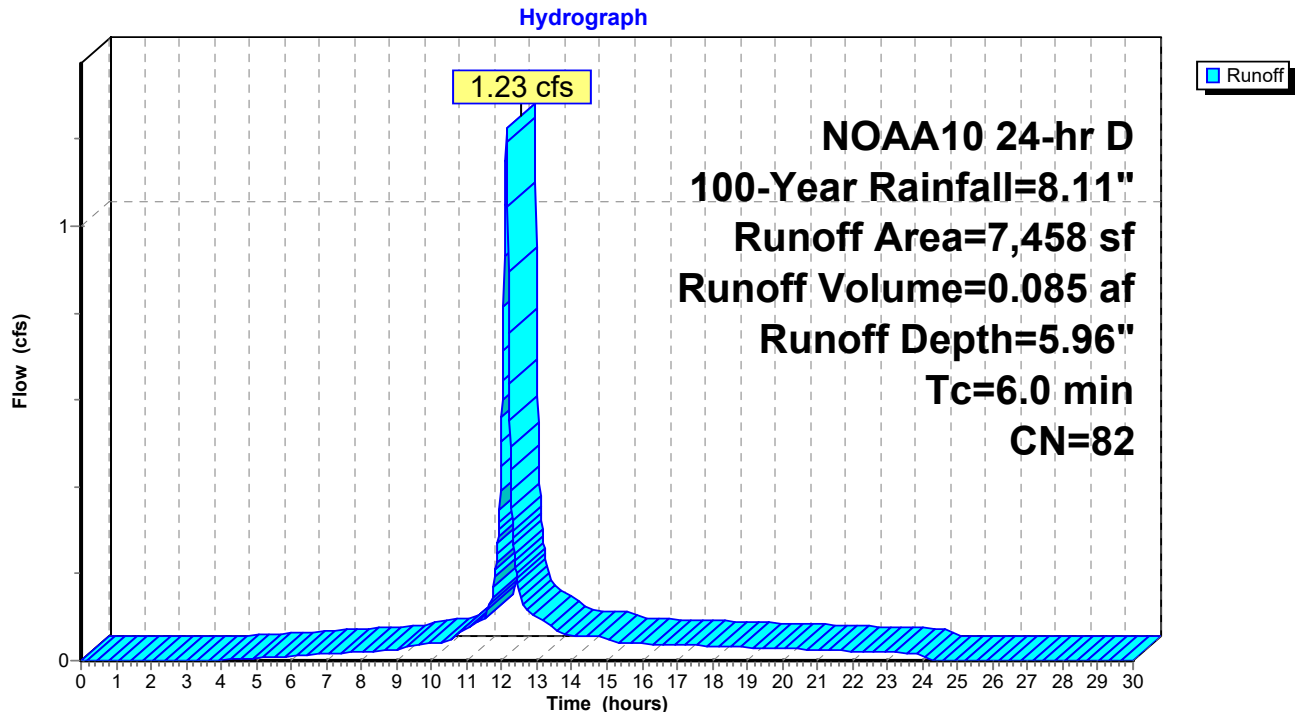
Runoff = 1.23 cfs @ 12.13 hrs, Volume= 0.085 af, Depth= 5.96"

Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
1,421	39	>75% Grass cover, Good, HSG A
2,055	98	Paved parking, HSG A
2,658	98	Roofs, HSG A
1,122	77	Fallow, bare soil, HSG A
202	30	Woods, Good, HSG A
7,458	82	Weighted Average
2,745		36.81% Pervious Area
4,713		63.19% Impervious Area

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

Subcatchment S4: Loading Dock

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Summary for Subcatchment S4-1: Garage Entrance

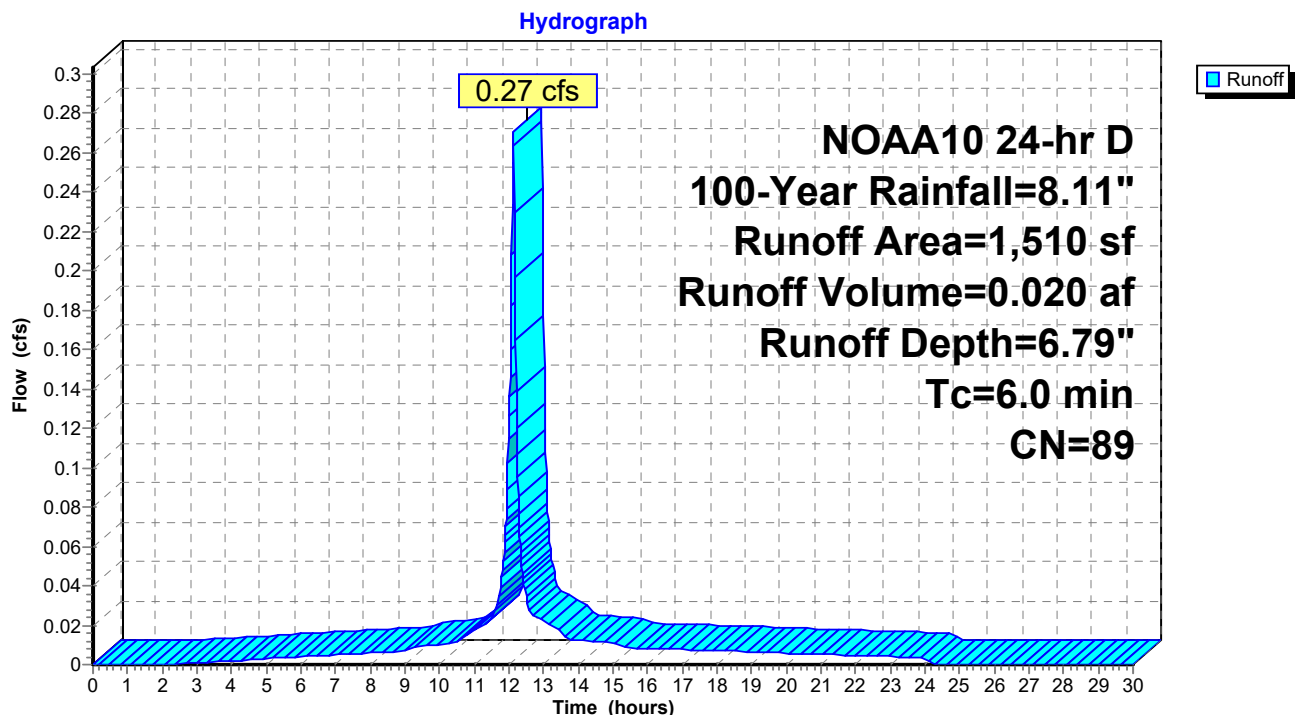
Runoff = 0.27 cfs @ 12.13 hrs, Volume= 0.020 af, Depth= 6.79"

Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
231	39	>75% Grass cover, Good, HSG A
323	96	Gravel surface, HSG A
956	98	Paved parking, HSG A
1,510	89	Weighted Average
554		36.69% Pervious Area
956		63.31% Impervious Area

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

Subcatchment S4-1: Garage Entrance

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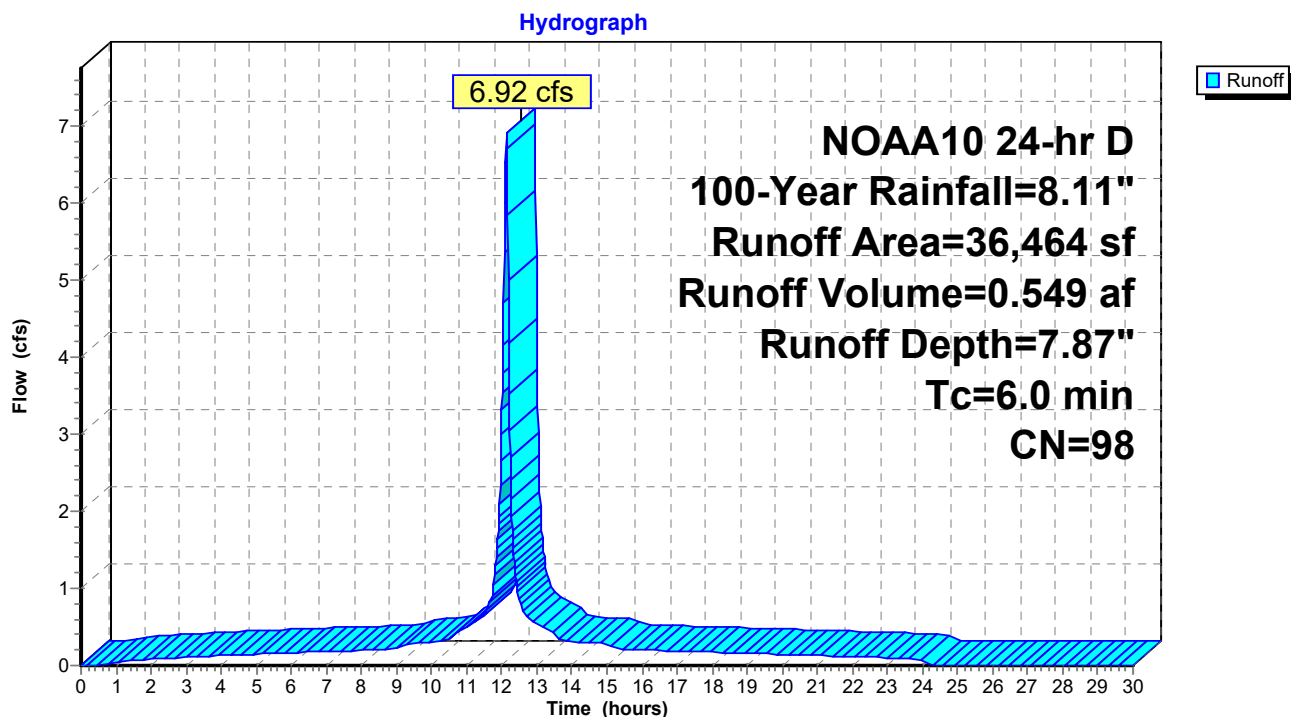
Summary for Subcatchment S4-2: Proposed Roofs

Runoff = 6.92 cfs @ 12.13 hrs, Volume= 0.549 af, Depth= 7.87"
Routed to Pond DC1 : Detention Chamber

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
36,464	98	Roofs, HSG A
36,464		100.00% Impervious Area

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

Subcatchment S4-2: Proposed Roofs

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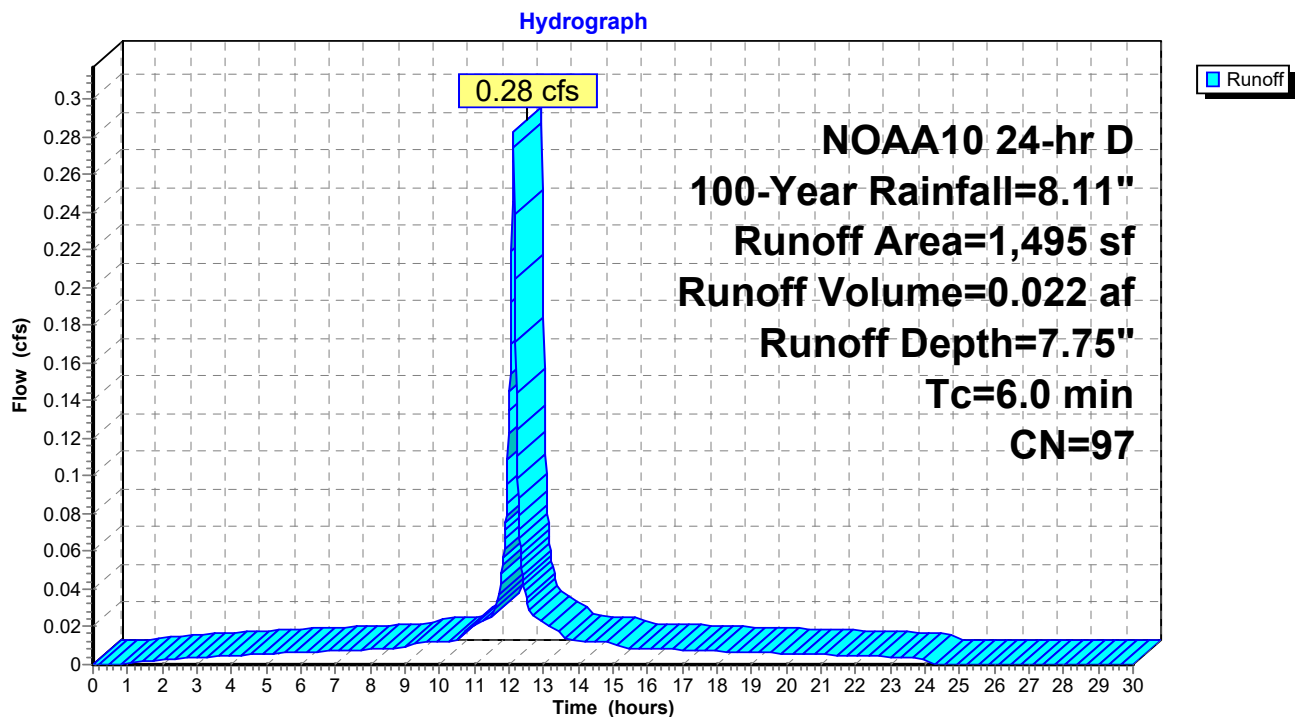
Summary for Subcatchment S4-3: Gap Between Buildings

Runoff = 0.28 cfs @ 12.13 hrs, Volume= 0.022 af, Depth= 7.75"
Routed to Pond GAP : Area Drain

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Area (sf)	CN	Description
559	96	Gravel surface, HSG A
936	98	Unconnected roofs, HSG A
1,495	97	Weighted Average
559		37.39% Pervious Area
936		62.61% Impervious Area
936		100.00% Unconnected

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

Subcatchment S4-3: Gap Between Buildings

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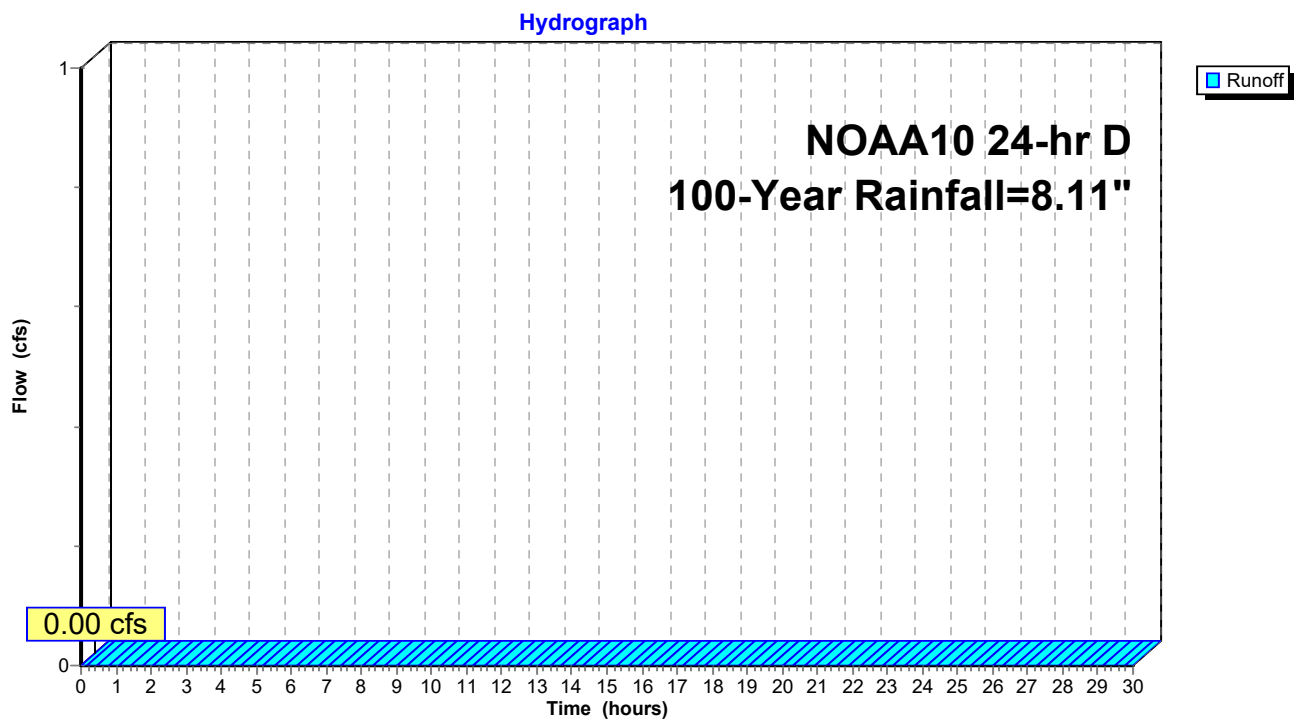
Summary for Subcatchment Tc: Extra Tc Calc's

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs
NOAA10 24-hr D 100-Year Rainfall=8.11"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	70	0.0501	5.28	4.15	Pipe Channel, CB 2 to DMH 1 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.1	33	0.1391	8.80	6.91	Pipe Channel, DMH 1 to DMH 2 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
0.3	139	0.0701	9.18	7.21	Pipe Channel, DMH 2 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
6.3	55	0.0182	0.15		Sheet Flow, Lawn (L2 to DP2) Grass: Short n= 0.150 P2= 3.24"
0.3	27	0.0079	1.33		Shallow Concentrated Flow, Lawn (DP2 to CB 8) Grassed Waterway Kv= 15.0 fps
0.4	47	0.0079	1.80		Shallow Concentrated Flow, Chestnut St. Gutter (DP2 to CB 8) Paved Kv= 20.3 fps
0.0	9	0.0811	9.88	7.76	Pipe Channel, CB 8 to DMH 3 12.00" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.017 Concrete sewer w/manholes & inlets
0.4	143	0.0222	6.77	11.97	Pipe Channel, DMH 3 to DMH 4 18.00" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.017 Concrete sewer w/manholes & inlets
8.0	523	Total			

Subcatchment Tc: Extra Tc Calc's



Summary for Pond CDS1: Water Quality Catch Basin

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 7.39" for 100-Year event
 Inflow = 2.31 cfs @ 12.13 hrs, Volume= 0.175 af
 Outflow = 2.31 cfs @ 12.13 hrs, Volume= 0.175 af, Atten= 0%, Lag= 0.0 min
 Primary = 2.31 cfs @ 12.13 hrs, Volume= 0.175 af
 Routed to Pond IC2 : Infiltration Chamber Under Parking Lot

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 51.79' @ 12.13 hrs

Flood Elev= 52.00'

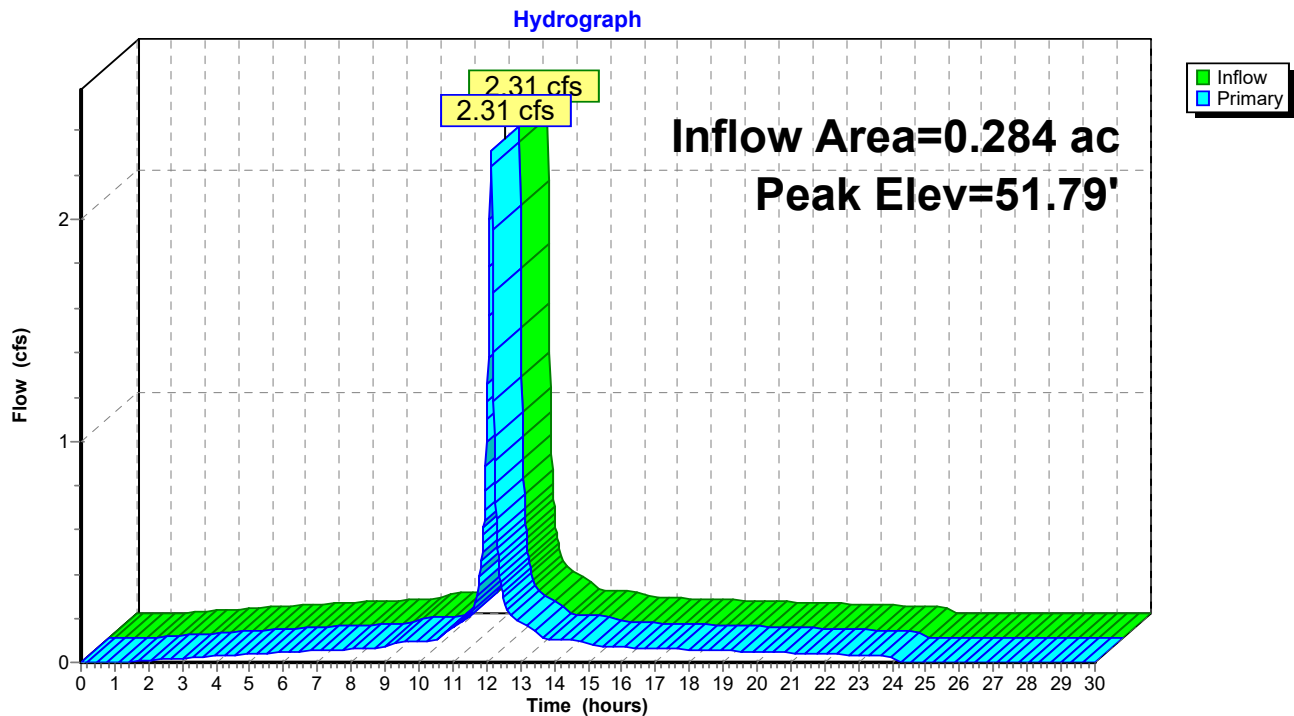
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 ' S= 0.0089 ' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=2.29 cfs @ 12.13 hrs HW=51.79' TW=50.45' (Dynamic Tailwater)

1=RCP Culvert (SD-3) (Passes 2.29 cfs of 4.38 cfs potential flow)

2=Neenah R1878-A6G Grate (Weir Controls 2.29 cfs @ 1.42 fps)

Pond CDS1: Water Quality Catch Basin



Summary for Pond DC1: Detention Chamber

Inflow Area = 0.871 ac, 98.53% Impervious, Inflow Depth = 7.87" for 100-Year event
 Inflow = 7.20 cfs @ 12.13 hrs, Volume= 0.571 af
 Outflow = 4.47 cfs @ 12.19 hrs, Volume= 0.571 af, Atten= 38%, Lag= 3.9 min
 Primary = 4.47 cfs @ 12.19 hrs, Volume= 0.571 af
 Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 28.38' @ 12.19 hrs Surf.Area= 543 sf Storage= 2,916 cf

Plug-Flow detention time= 12.6 min calculated for 0.571 af (100% of inflow)
 Center-of-Mass det. time= 12.4 min (755.2 - 742.8)

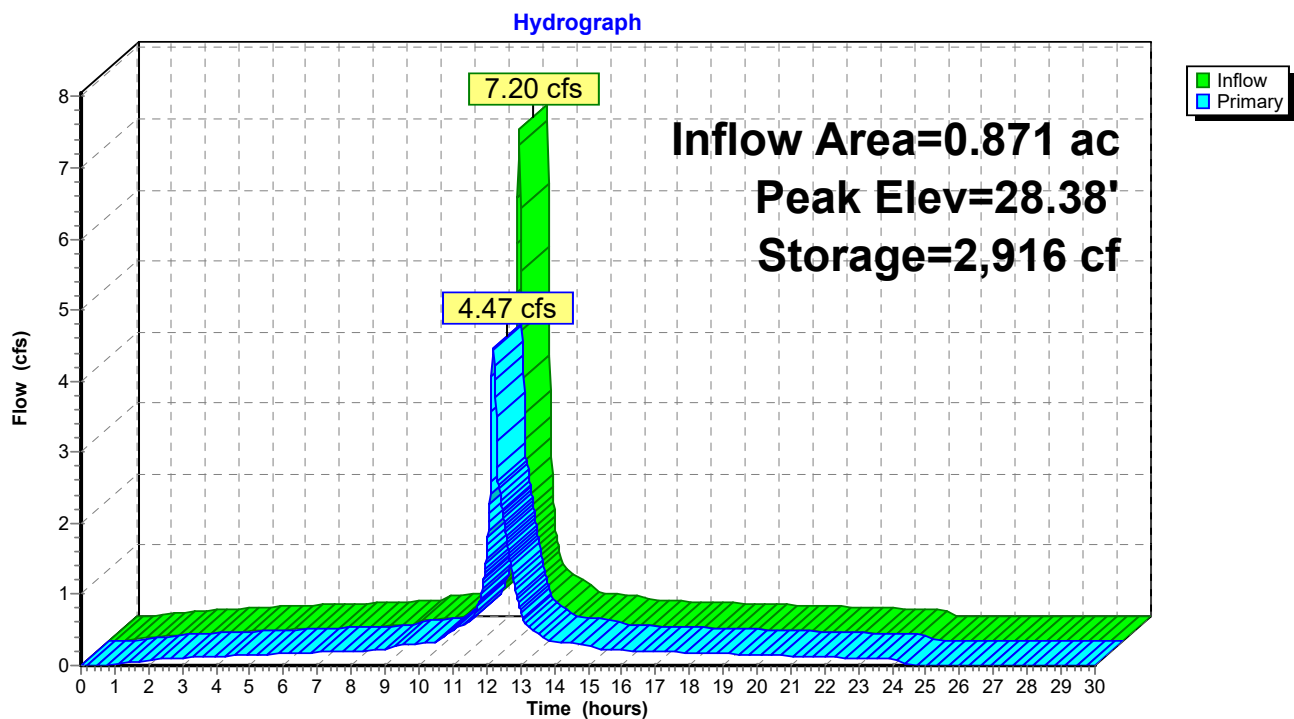
Volume	Invert	Avail.Storage	Storage Description
#1	23.01'	3,217 cf	8.67'W x 15.67'L x 5.92'H Shea Fire Cistern Bankx 4

Device	Routing	Invert	Outlet Devices
#1	Primary	23.01'	12.00" Round RCP Culvert (SD-1) L= 69.4' Ke= 1.800 Inlet / Outlet Invert= 23.01' / 22.66' S= 0.0050 '/ Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	23.01'	7.00" Vert. Control Orifice (2-yr & 10-yr) C= 0.600 Limited to weir flow at low heads
#3	Device 1	27.25'	4.00" Vert. Control Orifice (25-yr) X 4.00 C= 0.600 Limited to weir flow at low heads
#4	Device 1	28.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Primary OutFlow Max=4.47 cfs @ 12.19 hrs HW=28.37' TW=0.00' (Dynamic Tailwater)

- 1=RCP Culvert (SD-1) (Inlet Controls 4.47 cfs @ 5.69 fps)
- 2=Control Orifice (2-yr & 10-yr) (Passes < 2.90 cfs potential flow)
- 3=Control Orifice (25-yr) (Passes < 1.64 cfs potential flow)
- 4=Overflow Orifice (Passes < 0.45 cfs potential flow)

Pond DC1: Detention Chamber



Summary for Pond DSCB-1: Deep Sump Catch Basin

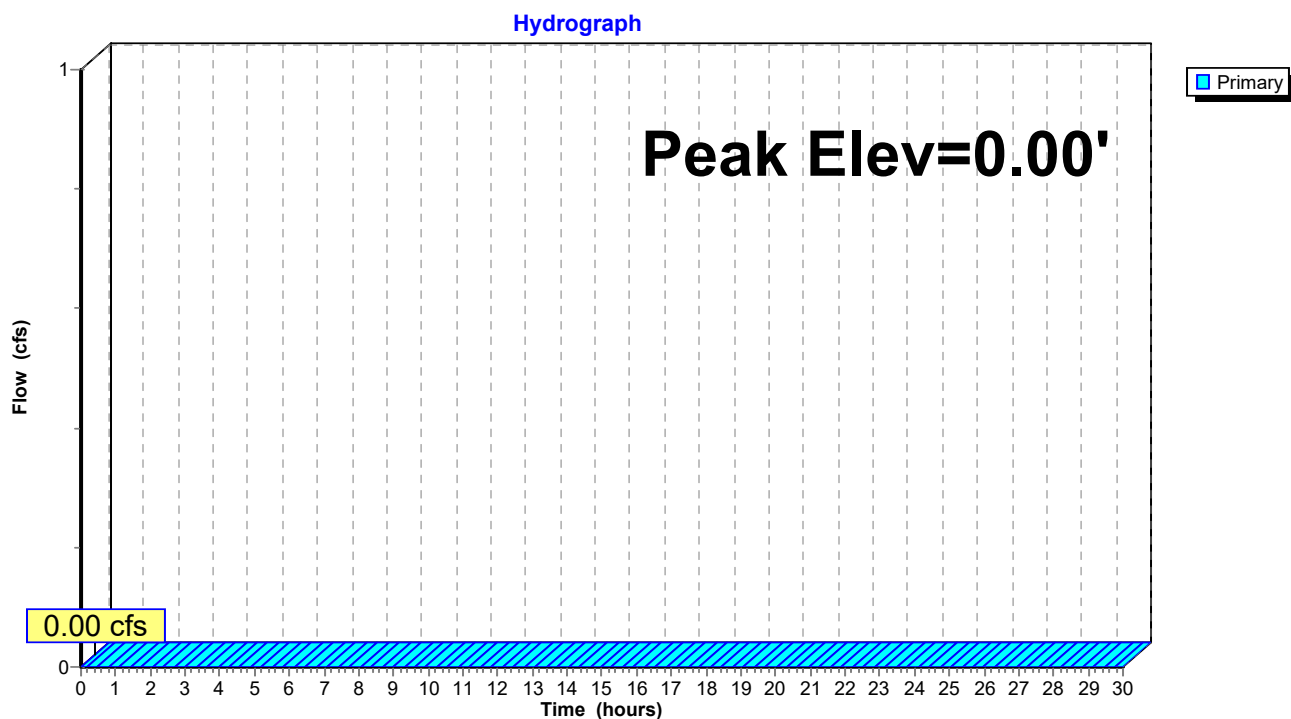
Device	Routing	Invert	Outlet Devices
#1	Primary	48.90'	12.00" Round Hooded RCP Culvert (SD-3) L= 22.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.90' / 48.70' S= 0.0089 1' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	51.60'	2.37" x 7.25" Horiz. Neenah R1878-A6G Grate X 8.00 columns X 3 rows C= 0.600 in 25.75" x 25.75" Grate (62% open area) Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)

1=Hooded RCP Culvert (SD-3) (Controls 0.00 cfs)

2=Neenah R1878-A6G Grate (Controls 0.00 cfs)

Pond DSCB-1: Deep Sump Catch Basin



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Summary for Pond GAP: Area Drain

Inflow Area = 0.034 ac, 62.61% Impervious, Inflow Depth = 7.75" for 100-Year event
 Inflow = 0.28 cfs @ 12.13 hrs, Volume= 0.022 af
 Outflow = 0.28 cfs @ 12.13 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.1 min
 Primary = 0.28 cfs @ 12.13 hrs, Volume= 0.022 af
 Routed to Pond DC1 : Detention Chamber

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2

Peak Elev= 54.50' @ 12.13 hrs Storage= 1 cf

Flood Elev= 55.00' Storage= 112 cf

Plug-Flow detention time= 0.0 min calculated for 0.022 af (100% of inflow)

Center-of-Mass det. time= 0.0 min (749.3 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1	54.50'	2,068 cf	Open Area (Prismatic) Listed below -Impervious

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
54.50	559	0.0	0	0
55.00	559	40.0	112	112
58.50	559	100.0	1,957	2,068

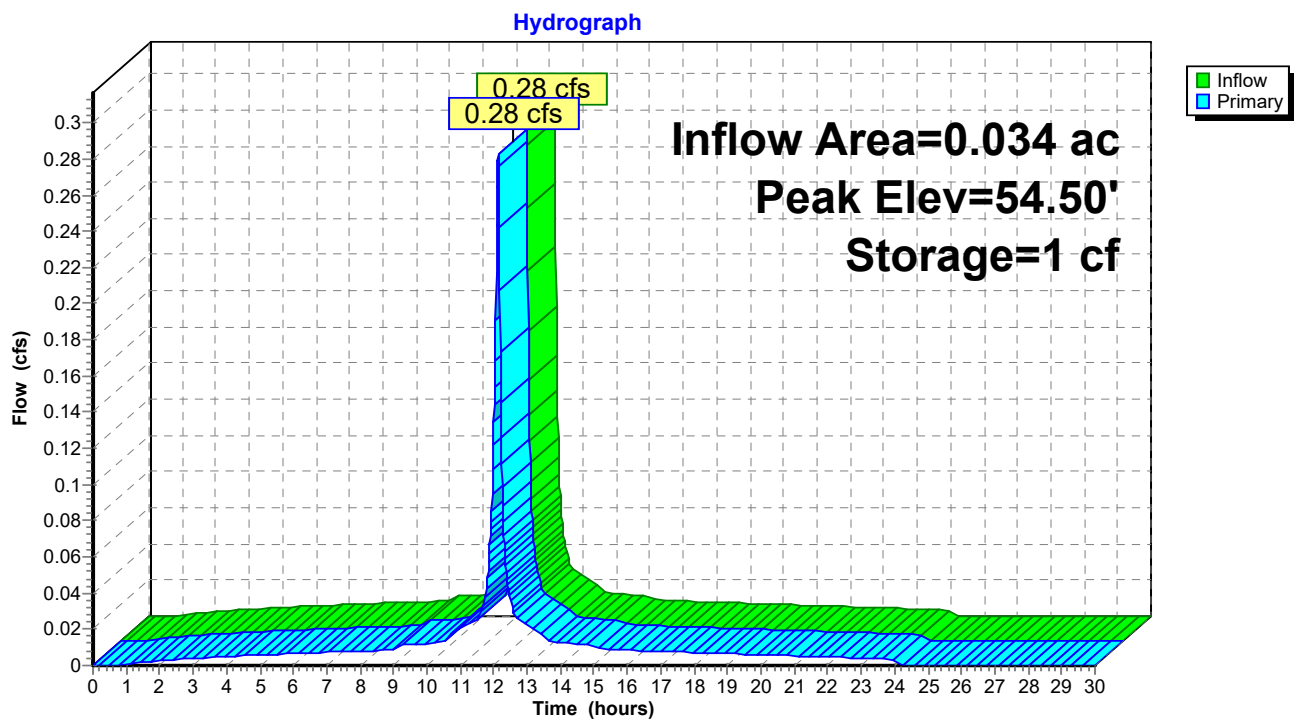
Device	Routing	Invert	Outlet Devices
#1	Primary	26.00'	6.00" Round Ductile Iron Drain Pipe (SD-4) L= 27.6' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 26.00' / 25.00' S= 0.0362 ' / ' Cc= 0.900 n= 0.014 Steel, smooth, Flow Area= 0.20 sf
#2	Device 1	54.50'	2.00" x 2.00" Horiz. Neenah R-3203-A Inlet Grate X 6.00 columns X 6 rows C= 0.600 in 20.00" x 20.00" Grate (36% open area)

Primary OutFlow Max=0.28 cfs @ 12.13 hrs HW=54.50' TW=27.56' (Dynamic Tailwater)

1=Ductile Iron Drain Pipe (SD-4) (Passes 0.28 cfs of 4.07 cfs potential flow)

2=Neenah R-3203-A Inlet Grate (Orifice Controls 0.28 cfs @ 0.28 fps)

Pond GAP: Area Drain



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Summary for Pond IC1: Infiltration Chamber Under Garage

Volume	Invert	Avail.Storage	Storage Description
#1A	22.73'	450 cf	50.00'W x 16.00'L x 6.17'H Field A 4,936 cf Overall - 3,810 cf Embedded = 1,126 cf x 40.0% Voids
#2A	23.23'	3,000 cf	Shea Leaching Chamber 8x14x5.7 x 6 Inside #1 Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf 6 Chambers in 6 Rows
		3,450 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	22.73'	25.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 15.00' Phase-In= 0.08'
#2	Primary	24.55'	12.00" Round RCP Culvert (SD-1) L= 70.7' Ke= 1.800 Inlet / Outlet Invert= 24.55' / 24.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	24.55'	4.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	27.60'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)↑ **1=Exfiltration** (Controls 0.00 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=0.00' (Free Discharge)↑ **2=RCP Culvert (SD-1)** (Controls 0.00 cfs)↑ **3=Control Orifice** (Controls 0.00 cfs)↑ **4=Overflow Orifice** (Controls 0.00 cfs)

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Pond IC1: Infiltration Chamber Under Garage - Chamber Wizard Field A

Chamber Model = Shea Leaching Chamber 8x14x5.7 (Shea Galley)

Inside= 84.0"W x 60.0"H => 38.46 sf x 13.00'L = 500.0 cf

Outside= 96.0"W x 68.0"H => 45.36 sf x 14.00'L = 635.0 cf

1 Chambers/Row x 14.00' Long = 14.00' Row Length +12.0" End Stone x 2 = 16.00' Base Length

6 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 50.00' Base Width

6.0" Stone Base + 68.0" Chamber Height = 6.17' Field Height

6 Chambers x 500.0 cf = 3,000.0 cf Chamber Storage

6 Chambers x 635.0 cf = 3,810.2 cf Displacement

4,936.0 cf Field - 3,810.2 cf Chambers = 1,125.8 cf Stone x 40.0% Voids = 450.3 cf Stone Storage

Chamber Storage + Stone Storage = 3,450.3 cf = 0.079 af

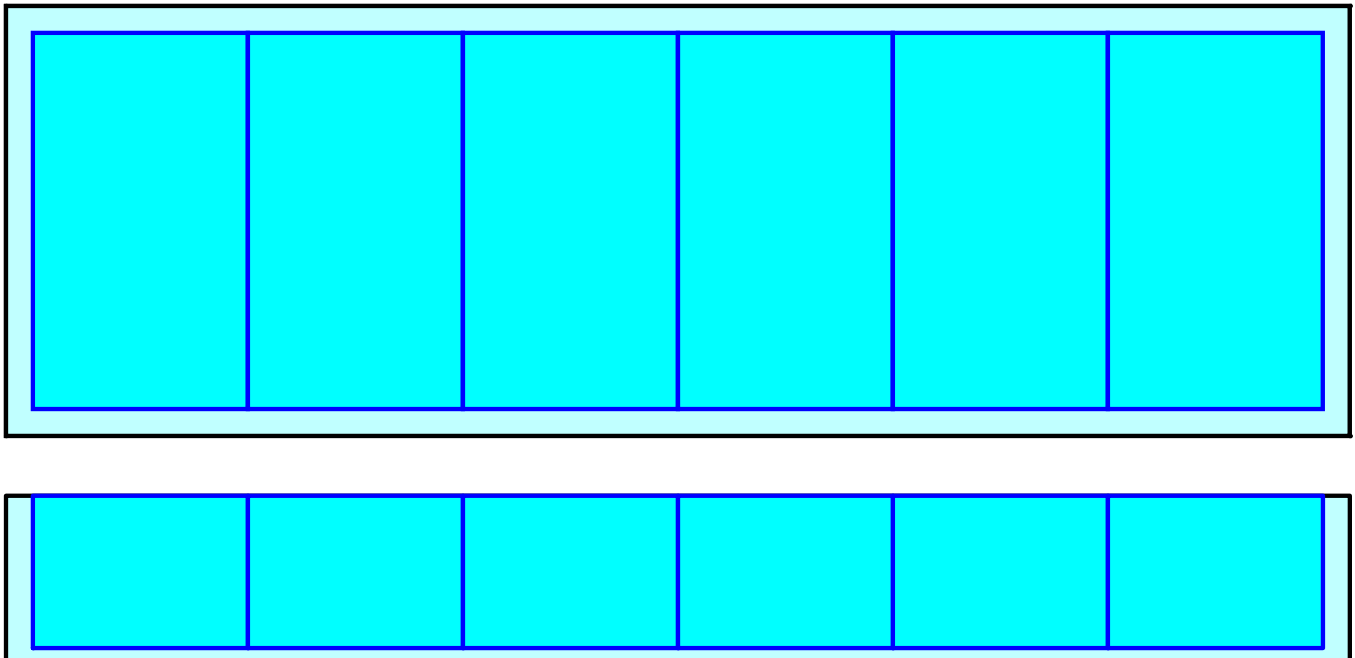
Overall Storage Efficiency = 69.9%

Overall System Size = 16.00' x 50.00' x 6.17'

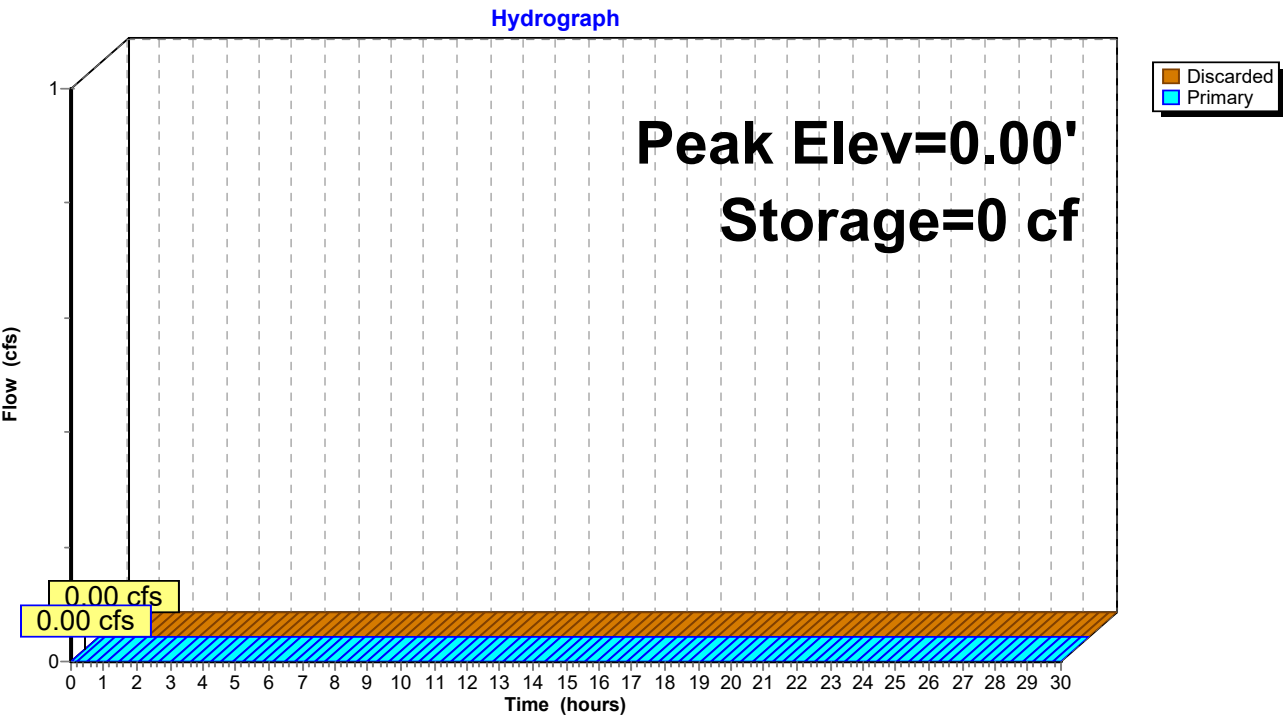
6 Chambers

182.8 cy Field

41.7 cy Stone



Pond IC1: Infiltration Chamber Under Garage



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Summary for Pond IC2: Infiltration Chamber Under Parking Lot

Inflow Area = 0.284 ac, 84.21% Impervious, Inflow Depth = 7.39" for 100-Year event
 Inflow = 2.31 cfs @ 12.13 hrs, Volume= 0.175 af
 Outflow = 1.83 cfs @ 12.17 hrs, Volume= 0.175 af, Atten= 21%, Lag= 2.6 min
 Discarded = 0.08 cfs @ 12.17 hrs, Volume= 0.101 af
 Primary = 1.75 cfs @ 12.17 hrs, Volume= 0.074 af
 Routed to Link DP1-1 : Oakland St. Catch Basin (CB 2)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs / 2
 Peak Elev= 50.58' @ 12.17 hrs Surf.Area= 540 sf Storage= 980 cf

Plug-Flow detention time= 46.7 min calculated for 0.175 af (100% of inflow)
 Center-of-Mass det. time= 46.7 min (813.1 - 766.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	48.08'	206 cf	18.00'W x 30.00'L x 3.17'H Field A 1,712 cf Overall - 1,196 cf Embedded = 516 cf x 40.0% Voids
#2A	48.58'	800 cf	Shea Leaching Chamber 8x14x2.7 x 4 Inside #1 Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf 4 Chambers in 2 Rows
		1,006 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	48.08'	4.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 17.50' Phase-In= 0.08'
#2	Primary	49.33'	12.00" Round RCP Culvert (SD-2) L= 53.0' Ke= 1.800 Inlet / Outlet Invert= 49.33' / 48.00' S= 0.0251 ' /' Cc= 0.900 n= 0.013 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#3	Device 2	49.33'	9.00" Vert. Control Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	50.25'	12.00" Horiz. Overflow Orifice C= 0.600 in 13.50" Grate (79% open area) Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 12.17 hrs HW=50.57' (Free Discharge)
 ↳ **1=Exfiltration** (Controls 0.08 cfs)

Primary OutFlow Max=1.75 cfs @ 12.17 hrs HW=50.57' TW=0.00' (Dynamic Tailwater)
 ↳ **2=RCP Culvert (SD-2)** (Inlet Controls 1.75 cfs @ 2.22 fps)
 ↳ **3=Control Orifice** (Passes < 1.98 cfs potential flow)
 ↳ **4=Overflow Orifice** (Passes < 1.89 cfs potential flow)

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Pond IC2: Infiltration Chamber Under Parking Lot - Chamber Wizard Field A

Chamber Model = Shea Leaching Chamber 8x14x2.7 (Shea Galley)

Inside= 84.0"W x 24.0"H => 15.38 sf x 13.00'L = 200.0 cf

Outside= 96.0"W x 32.0"H => 21.36 sf x 14.00'L = 299.0 cf

2 Chambers/Row x 14.00' Long = 28.00' Row Length +12.0" End Stone x 2 = 30.00' Base Length

2 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 18.00' Base Width

6.0" Stone Base + 32.0" Chamber Height = 3.17' Field Height

4 Chambers x 200.0 cf = 800.0 cf Chamber Storage

4 Chambers x 299.0 cf = 1,196.2 cf Displacement

1,711.8 cf Field - 1,196.2 cf Chambers = 515.6 cf Stone x 40.0% Voids = 206.3 cf Stone Storage

Chamber Storage + Stone Storage = 1,006.3 cf = 0.023 af

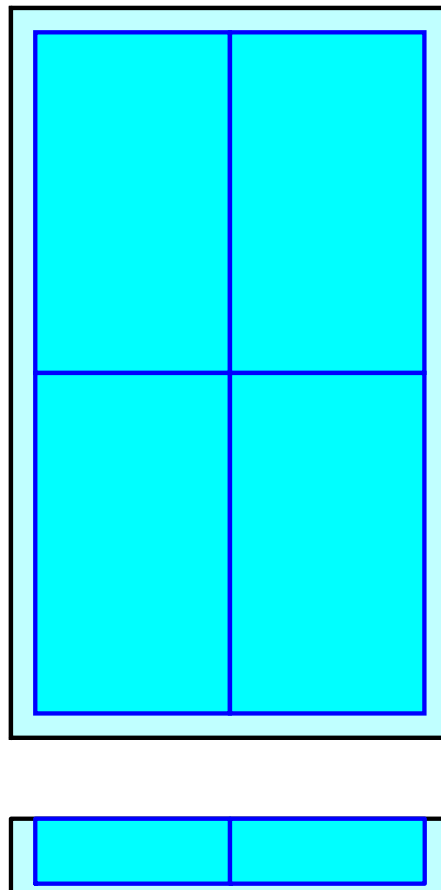
Overall Storage Efficiency = 58.8%

Overall System Size = 30.00' x 18.00' x 3.17'

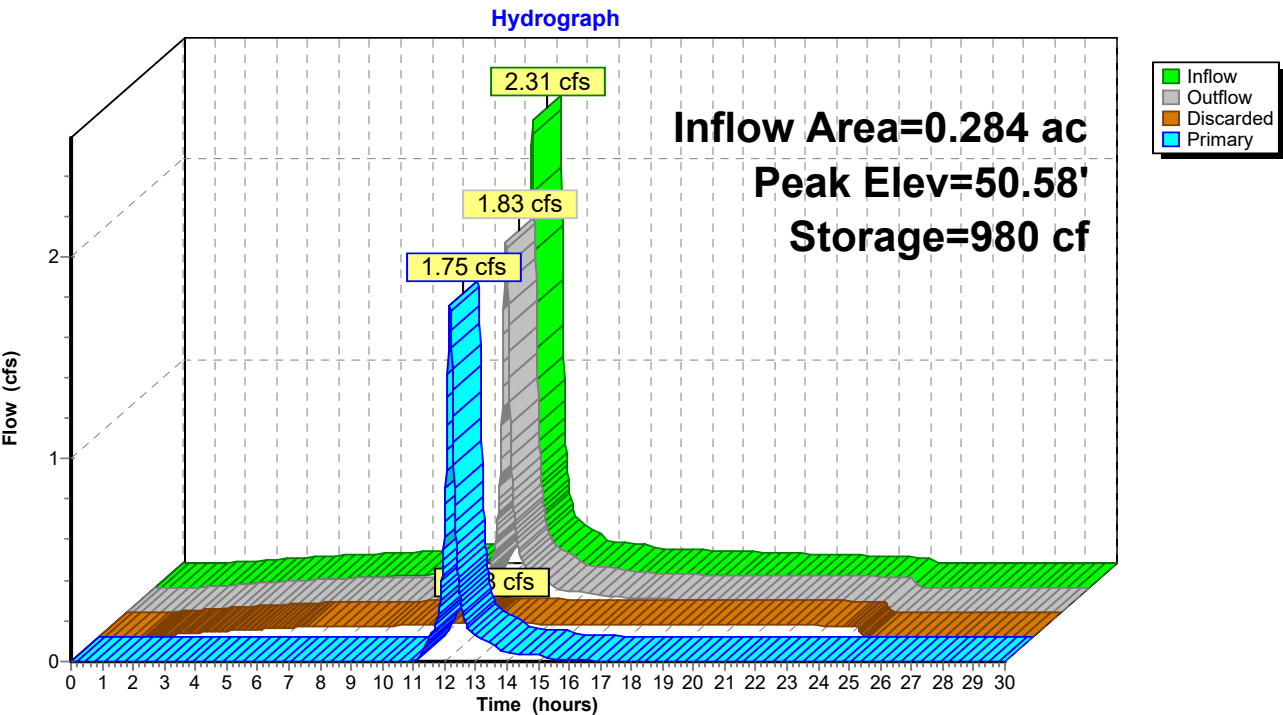
4 Chambers

63.4 cy Field

19.1 cy Stone



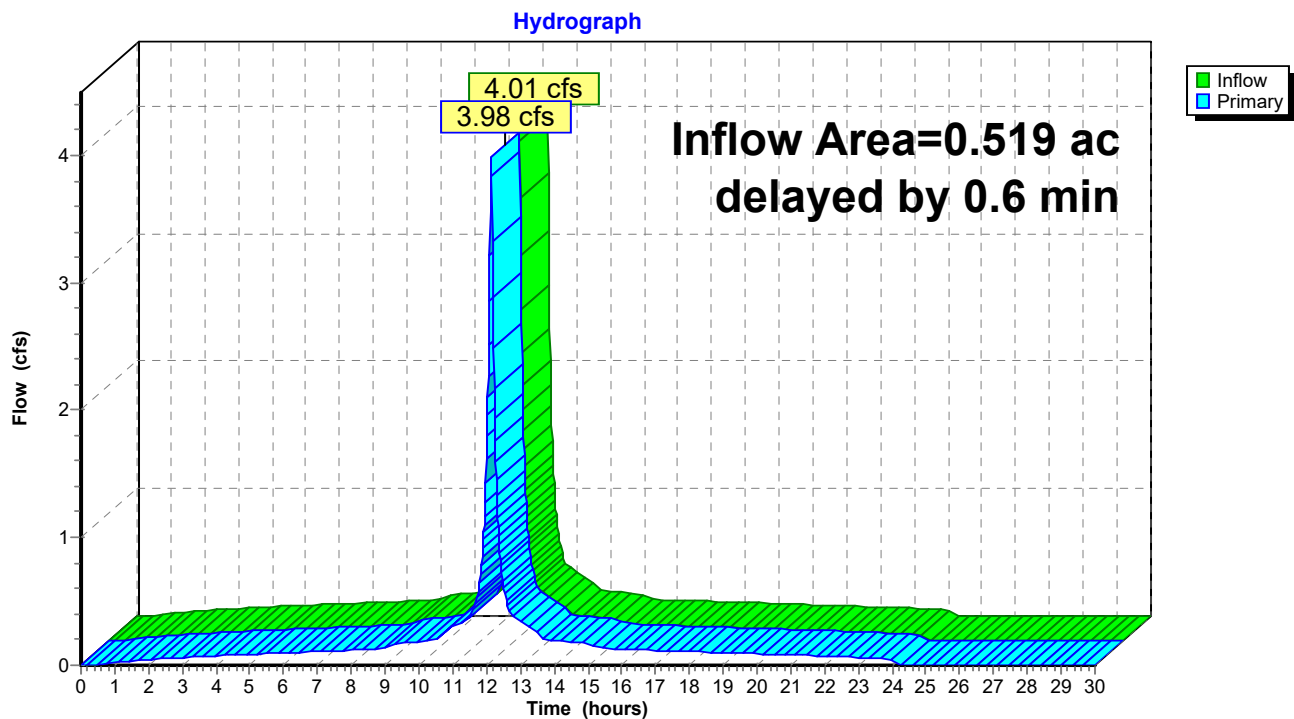
Pond IC2: Infiltration Chamber Under Parking Lot



Summary for Link DP1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.519 ac, 98.58% Impervious, Inflow Depth = 7.77" for 100-Year event
Inflow = 4.01 cfs @ 12.13 hrs, Volume= 0.336 af
Primary = 3.98 cfs @ 12.14 hrs, Volume= 0.336 af, Atten= 1%, Lag= 0.6 min
Routed to Link DP3 : Chestnut St. Drain Manhole (DMH 3)

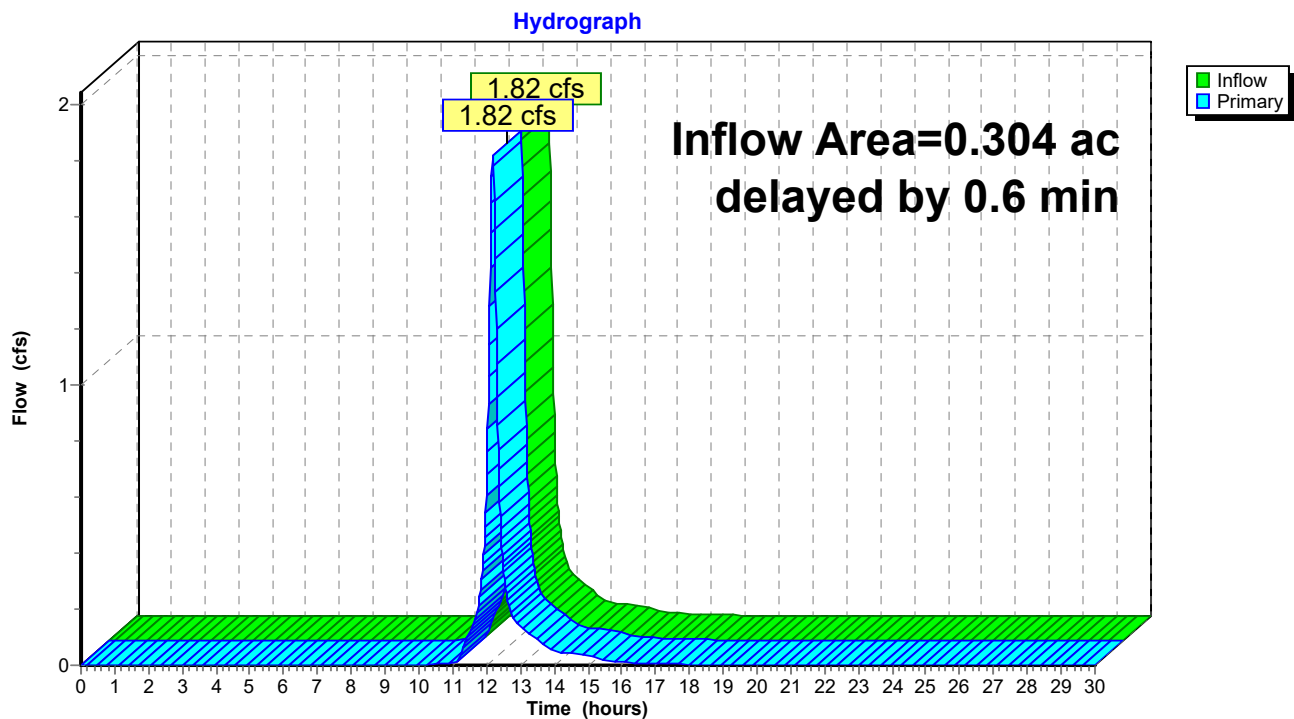
Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP1: Oakland St. Catch Basin (CB 2)

Summary for Link DP1-1: Oakland St. Catch Basin (CB 2)

Inflow Area = 0.304 ac, 81.38% Impervious, Inflow Depth = 3.18" for 100-Year event
Inflow = 1.82 cfs @ 12.17 hrs, Volume= 0.080 af
Primary = 1.82 cfs @ 12.18 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.6 min
Routed to Link DP3-1 : Chestnut St. Drain Manhole (DMH 3)

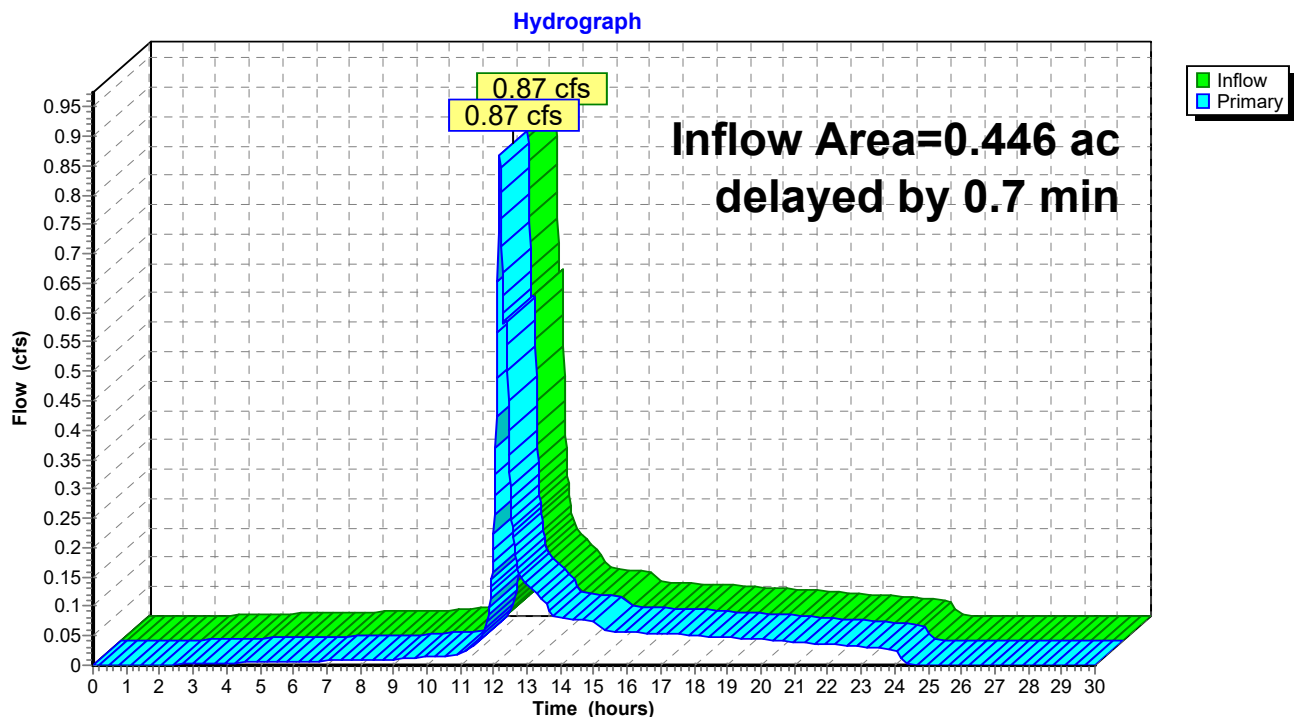
Primary outflow = Inflow delayed by 0.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP1-1: Oakland St. Catch Basin (CB 2)

Summary for Link DP2: Overland to City Drain (CB 8) via Lot 97

Inflow Area = 0.446 ac, 30.85% Impervious, Inflow Depth = 2.41" for 100-Year event
Inflow = 0.87 cfs @ 12.17 hrs, Volume= 0.089 af
Primary = 0.87 cfs @ 12.18 hrs, Volume= 0.089 af, Atten= 0%, Lag= 0.7 min
Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

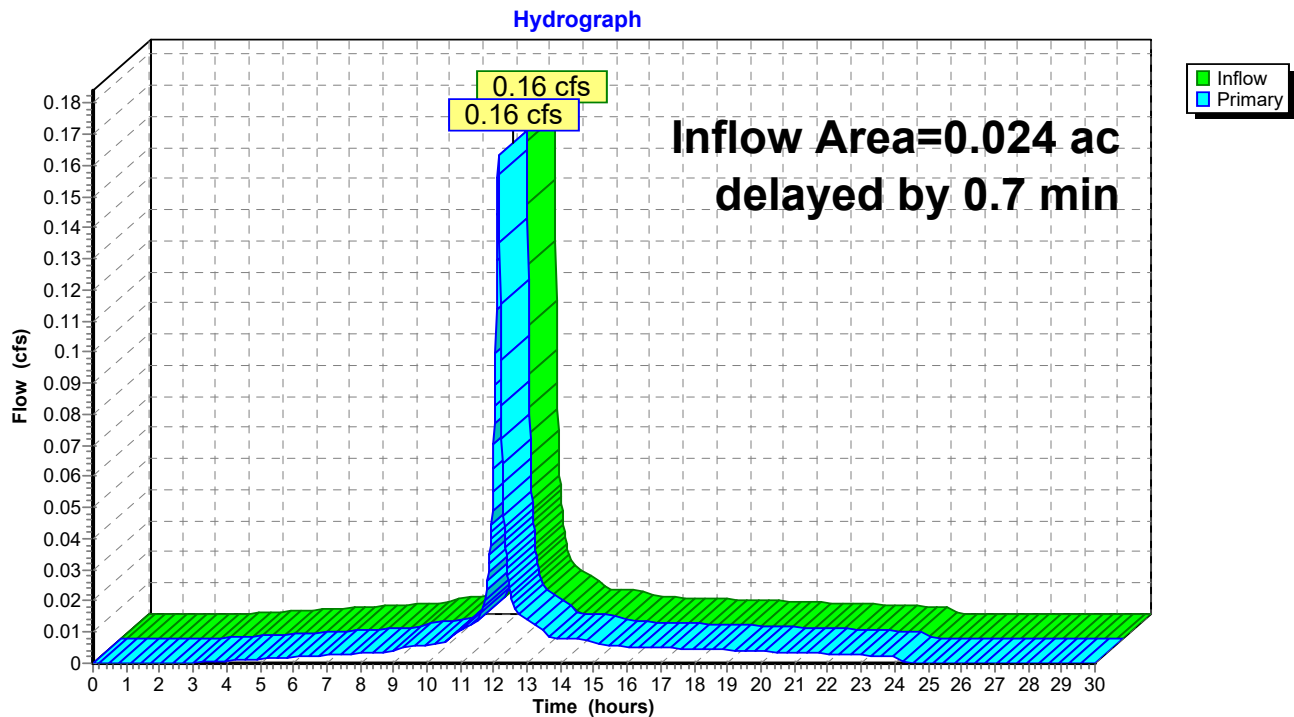
Primary outflow = Inflow delayed by 0.7 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP2: Overland to City Drain (CB 8) via Lot 97

Summary for Link DP2-1: Overland to City Drain (CB 8) via Lot 97

Inflow Area = 0.024 ac, 0.00% Impervious, Inflow Depth = 5.86" for 100-Year event
Inflow = 0.16 cfs @ 12.13 hrs, Volume= 0.012 af
Primary = 0.16 cfs @ 12.14 hrs, Volume= 0.012 af, Atten= 1%, Lag= 0.7 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

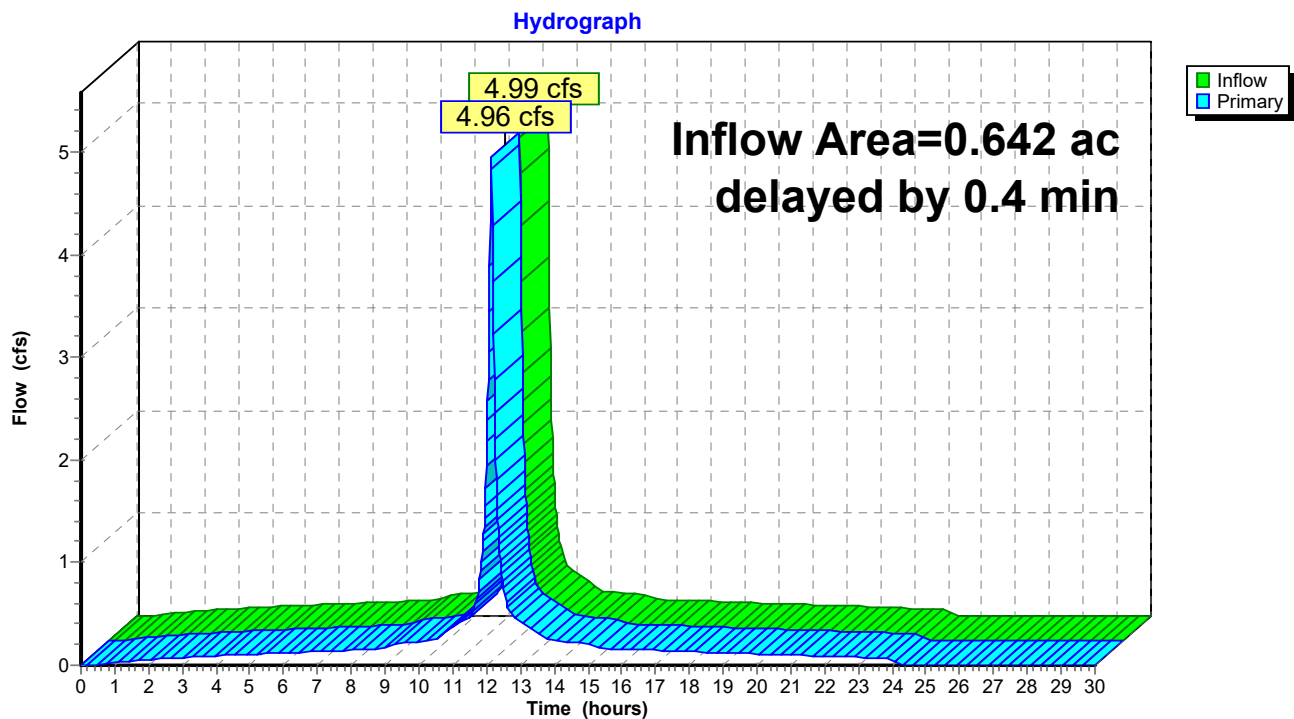
Primary outflow = Inflow delayed by 0.7 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP2-1: Overland to City Drain (CB 8) via Lot 97

Summary for Link DP3: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.642 ac, 98.80% Impervious, Inflow Depth = 7.79" for 100-Year event
Inflow = 4.99 cfs @ 12.14 hrs, Volume= 0.417 af
Primary = 4.96 cfs @ 12.14 hrs, Volume= 0.417 af, Atten= 1%, Lag= 0.4 min
Routed to Link DP4 : Chestnut St. Drain Manhole (DMH 4)

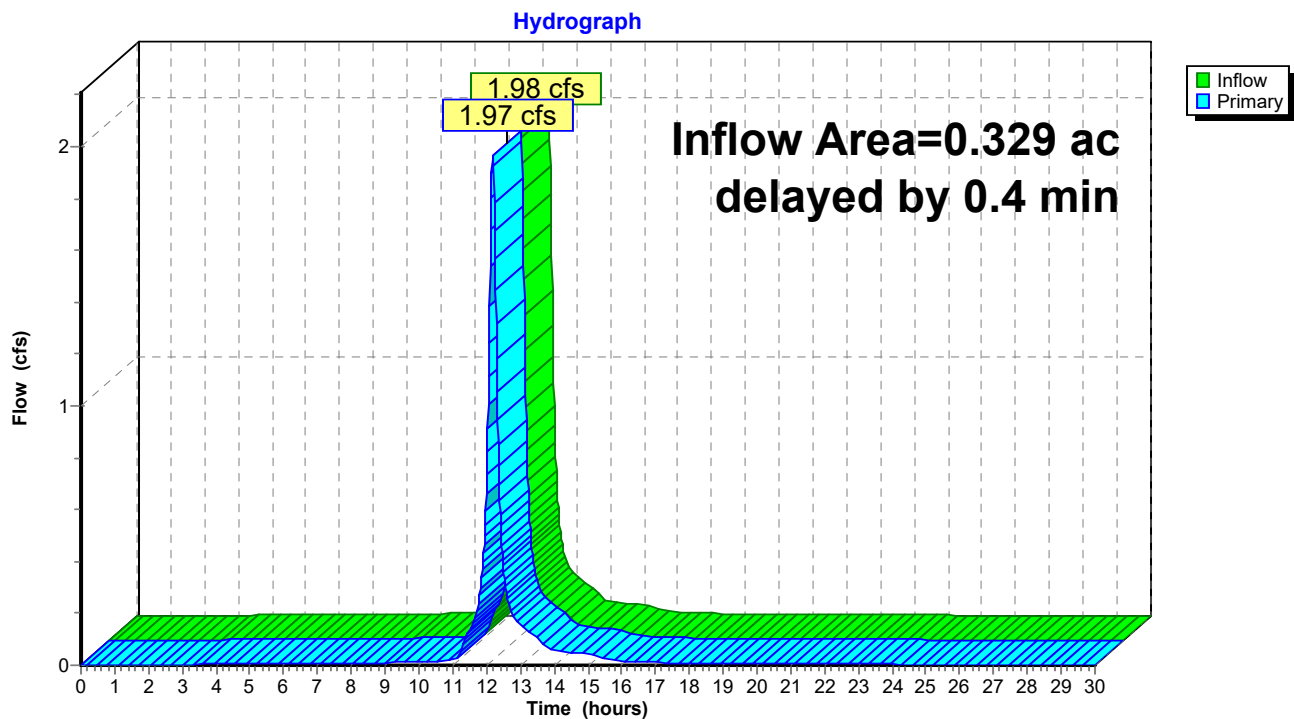
Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3: Chestnut St. Drain Manhole (DMH 3)

Summary for Link DP3-1: Chestnut St. Drain Manhole (DMH 3)

Inflow Area = 0.329 ac, 82.42% Impervious, Inflow Depth = 3.53" for 100-Year event
Inflow = 1.98 cfs @ 12.17 hrs, Volume= 0.097 af
Primary = 1.97 cfs @ 12.18 hrs, Volume= 0.097 af, Atten= 0%, Lag= 0.4 min
Routed to Link DP4-1 : Chestnut St. Drain Manhole (DMH 4)

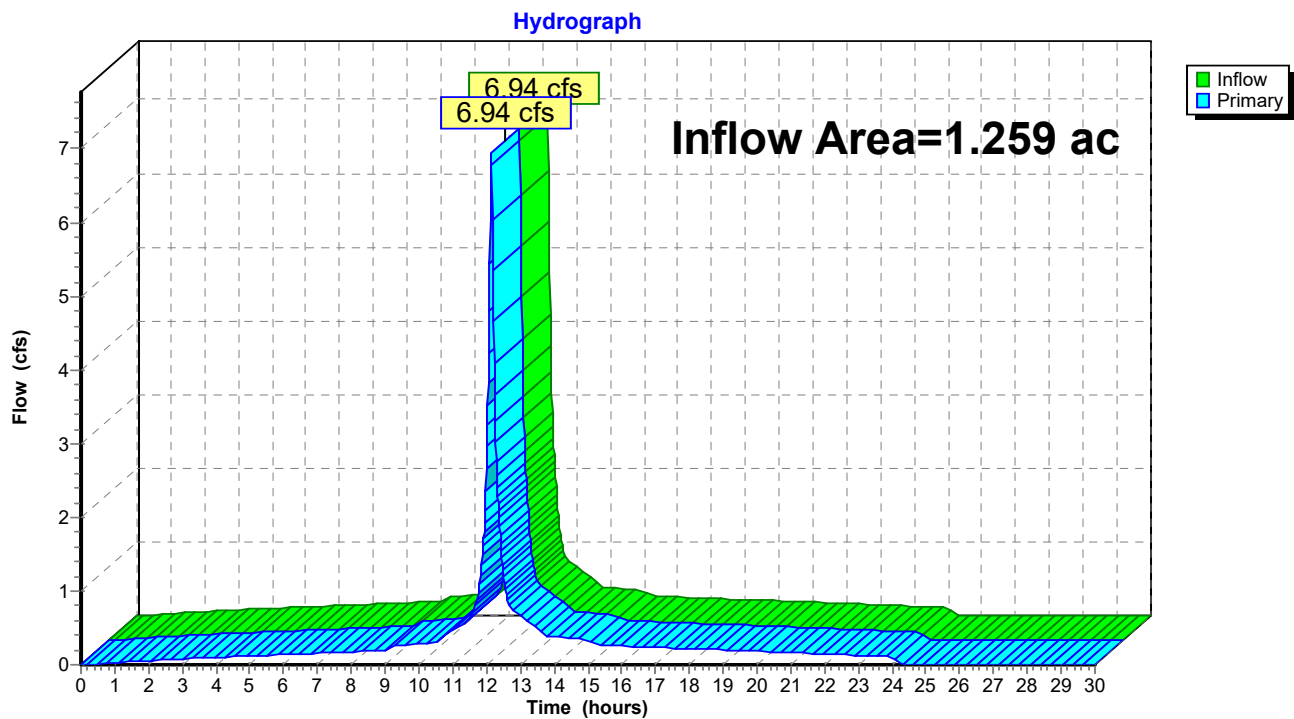
Primary outflow = Inflow delayed by 0.4 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP3-1: Chestnut St. Drain Manhole (DMH 3)

Summary for Link DP4: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 69.90% Impervious, Inflow Depth = 5.64" for 100-Year event
Inflow = 6.94 cfs @ 12.14 hrs, Volume= 0.591 af
Primary = 6.94 cfs @ 12.14 hrs, Volume= 0.591 af, Atten= 0%, Lag= 0.0 min

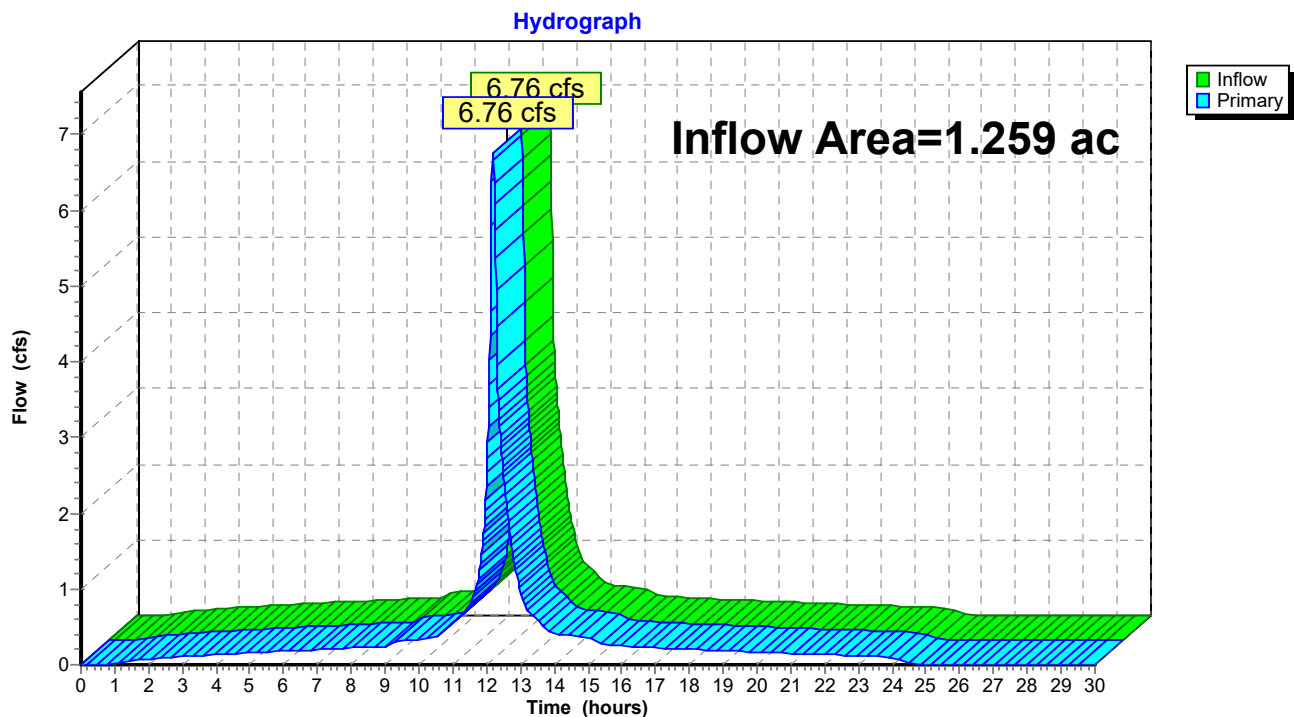
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP4: Chestnut St. Drain Manhole (DMH 4)

Summary for Link DP4-1: Chestnut St. Drain Manhole (DMH 4)

Inflow Area = 1.259 ac, 91.44% Impervious, Inflow Depth = 6.66" for 100-Year event
Inflow = 6.76 cfs @ 12.18 hrs, Volume= 0.699 af
Primary = 6.76 cfs @ 12.18 hrs, Volume= 0.699 af, Atten= 0%, Lag= 0.0 min

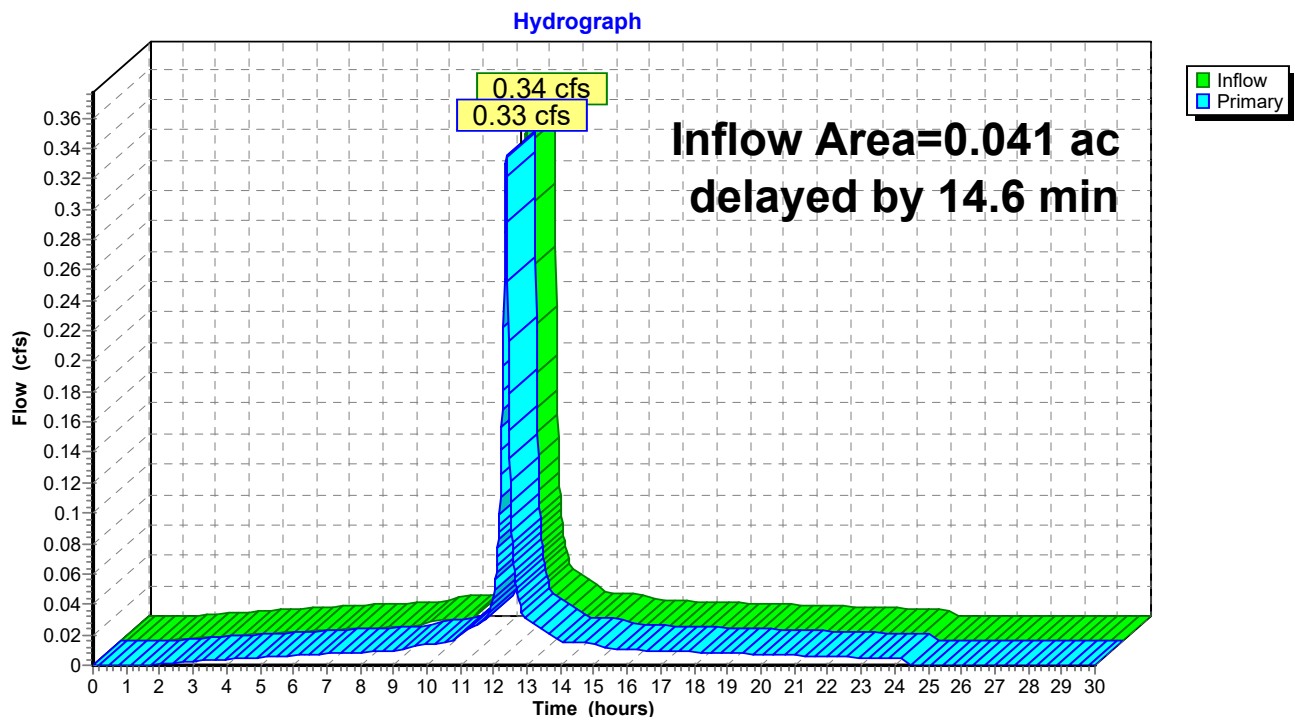
Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link DP4-1: Chestnut St. Drain Manhole (DMH 4)

Summary for Link L2: Lag Time for Flow from S2B to DP2

Inflow Area = 0.041 ac, 93.46% Impervious, Inflow Depth = 7.39" for 100-Year event
Inflow = 0.34 cfs @ 12.13 hrs, Volume= 0.025 af
Primary = 0.33 cfs @ 12.37 hrs, Volume= 0.025 af, Atten= 0%, Lag= 14.6 min
Routed to Link DP2 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 14.6 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

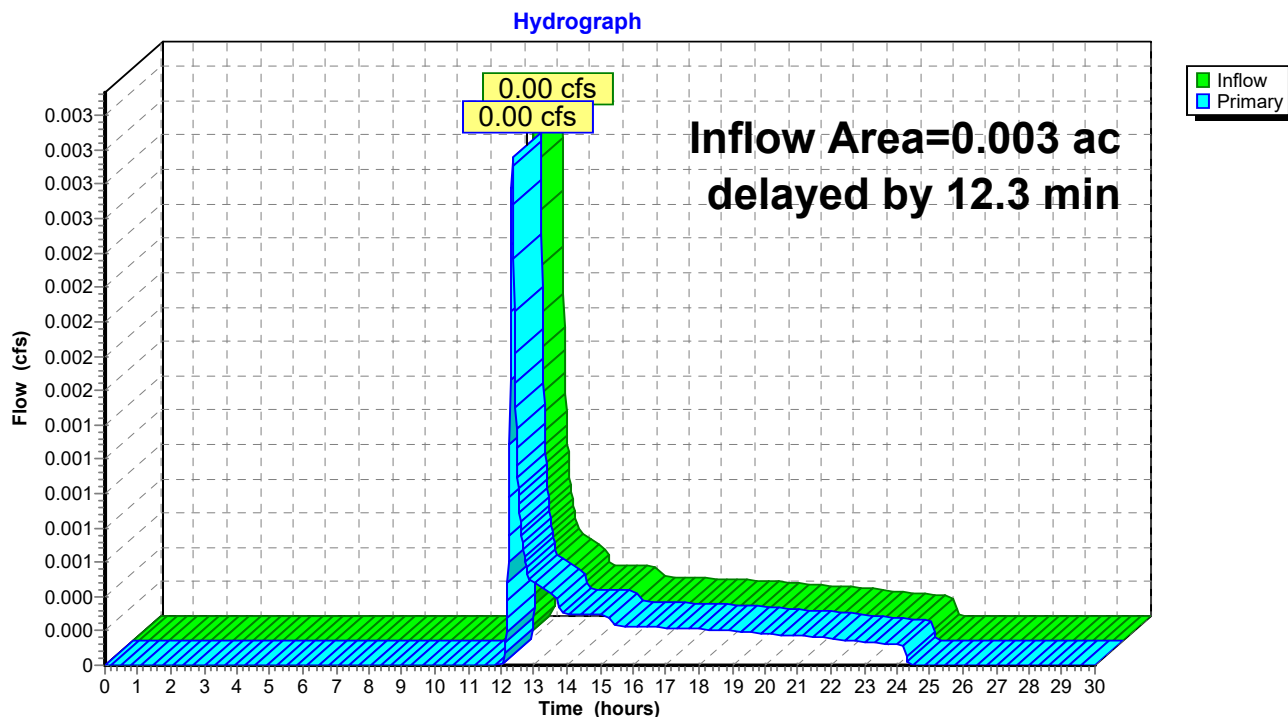
Link L2: Lag Time for Flow from S2B to DP2

Summary for Link L2-1: Lag Time for Flow from S2B-1 to DP2-1

Inflow Area = 0.003 ac, 0.00% Impervious, Inflow Depth = 1.20" for 100-Year event
 Inflow = 0.00 cfs @ 12.14 hrs, Volume= 0.000 af
 Primary = 0.00 cfs @ 12.35 hrs, Volume= 0.000 af, Atten= 1%, Lag= 12.3 min
 Routed to Link DP2-1 : Overland to City Drain (CB 8) via Lot 97

Primary outflow = Inflow delayed by 12.3 min, Time Span= 0.00-30.00 hrs, dt= 0.015 hrs

Link L2-1: Lag Time for Flow from S2B-1 to DP2-1



ATTACHMENT 5)
STORMWATER MANAGEMENT OPERATION &
MAINTENANCE PLAN

MILLENNIUM ENGINEERING, INC.

Land Surveyors and Civil Engineers



LONG-TERM POLLUTION PREVENTION
AND OPERATION & MAINTENANCE PLAN
FOR STORMWATER MANAGEMENT

AT

OAK STREET LOFTS
9 OAKLAND ST.
AMESBURY, MA

PREPARED FOR

9 OAKLAND STREET LLC.
PO Box 999
DANVILLE, NH 03819

DATE: 3/30/2026

Massachusetts:

62 Elm Street
Salisbury, MA 01952
Phone: 978-463-8980

New Hampshire:

13 Hampton Road
Exeter, NH 03833
Phone: 603-778-0528

INTRODUCTION

This long-term Stormwater Management System Operations and Maintenance (O&M) Plan, filed with the City of Amesbury, shall be implemented for the proposed Oak Street Lofts redevelopment to ensure that the stormwater management system functions as designed. The Owner holds the primary responsibility for overseeing and implementing the O&M Plan and assigning a Property Manager who will be responsible for the proper operation and maintenance of the stormwater structures. In case of transfer of property ownership, future property owners shall be notified of the presence of the stormwater management system and the requirements for proper implementation of the O&M Plan. At the time of this writing, the cost of annual maintenance activities for the stormwater BMP's is estimated to be \$4,500.00/year. Included in the manual is a Stormwater Management O&M Plan identifying the key components of the stormwater system and a log for tracking inspections and maintenance.

The stormwater management system protects and enhances the stormwater runoff water quality through the removal of sediment and pollutants, and source control significantly reduces the number of pollutants entering the system. Preventive maintenance of the system will include a comprehensive source reduction program of regular vacuuming and litter removal, and prohibitions on the use of pesticides.

The purpose of the Stormwater Operations and Maintenance (O&M) plan is to ensure inspection of the system, removal of accumulated sediments, oils, and debris, and implementation of corrective action and record keeping activities.

The ongoing responsibility is the Owner, its successors, and assigns. Adequate maintenance is defined in this document as good working condition.

Contact information is provided below:

Responsibility for Operations and Maintenance
Dale Development, LLC
360 Washington Street
Rye, NH

ILLICIT DISCHARGE COMPLIANCE STATEMENT:

I, _____ (Signing on behalf of the owner Sweet Management, Inc.)
verify that all illicit discharges to the stormwater management system are prohibited and no illicit
discharges exist on the site.

FINAL STABILIZATION

Permanent Seeding

Loam and hydroseed any disturbed surfaces after the final design grades have been achieved. A minimum of 6" of loam shall be installed. Seed mix shall be a maximum of 10% rye grass and a minimum of 90% permanent bluegrass and/or fescue. Lime shall be applied at a rate of 2 tons/acre.

Construction debris, trash and temporary BMPs (including silt fences, material storage areas, and inlet protection) will also be removed and any areas disturbed during removal will be seeded immediately.

POST CONSTRUCTION BMP'S

Snow & Snow Melt Management

Maintenance Activities: Storage and removal of snow. Application of deicing compounds and management of snowmelt. Snow will be stored in areas adjacent to the edge of the roadway and/or within the areas shown on the project plans. Stored snow must be allowed to melt naturally. Alternative deicing compounds, such as calcium chloride and calcium magnesium acetate, will be investigated for use. Professional services will be used for snow management.

Activity Frequency: Seasonally.

Activity Purpose: Minimize the likelihood of a sudden high flow or a sudden increase in the pollutant concentration caused by rapid melting.

Proprietary Water Quality Catch Basins

Maintenance Activities: Visual inspection, removal of collected sediment and other debris. Sediment and debris must be disposed of at a landfill or other facility that has been approved by MADEP to accept them. As with any proprietary BMP, always check with the manufacturer for additional maintenance requirements.

Activity Frequency: Four visual inspections per year. If debris is observed during the inspection, remove it immediately. Sediment must be removed from the sump as needed to prevent six or more inches of from accumulating. As with any proprietary BMP, always check with the manufacturer regarding the frequency of additional maintenance requirements.

Activity Purpose: Prevent debris clogs from reducing discharge capacity. Prevent floating hydrocarbons like oils and gasoline from reaching the infiltration chambers where they could be released into the groundwater. Prevent sediment from accumulating to the point where it can be resuspended and carried out of the catch basin.

Infiltration Chambers & Cisterns

Maintenance Activities: Visual inspection, removal of collected sediment and other debris. Sediment and other grit can be removed manually with buckets and shovels or mechanically with a vacuum truck. Personnel shall be advised that entering the chambers is considered entrance

Activity Frequency: During the first 4 months of operation, visually inspect the chambers after any storm that drops more than one inch of rain within a 24-hr period. After the first four

months, chambers must be inspected no less than twice per year; once in late spring/early summer, and once in the autumn before snow begins to fall. Any debris found during an inspection should be removed immediately, and sediment should be removed frequently enough that no more than three inches is ever allowed to accumulate. If the chamber takes more than 48 hours to fully drain, remove all accumulated sediment regardless of how much has accumulated.

Purpose of Activity: The chamber cannot function properly if excessive sediment is allowed to build up. If this happens, storms that the chambers were designed to handle will instead overwhelm them; and pressurize the water within them. This excess pressure causes sediment and other pollutants to escape, and it could damage components of the chambers.

LONG-TERM OPERATION AND MAINTENANCE PLAN

Good Housekeeping

The site shall be regularly inspected for any trash and debris. Any trash or debris shall be picked up and placed into waste containers.

Storing of Materials & Waste Products Inside or Under Cover

It is not anticipated that there will be storing of materials or waste products on site. If any materials are to be stored, they shall be stored inside or under cover.

Spill Control/Notification Practices

In addition to the good housekeeping and material management practices discussed above, the following practices will be followed for spill control, notification, and cleanup:

- a) Manufacturer's recommended methods for spill cleanup will be clearly posted, and project area personnel will be informed of the procedures and the location of the information and cleanup supplies.
- b) Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include, but will not be limited to, shovels, wheelbarrows, brooms, dust pans, mops, rags, gloves, goggles, kitty litter or Speedi-Dry, sand, sawdust, and plastic and metal trash containers specifically designated for this purpose.
- c) All spills will be cleaned up immediately after discovery.
- d) The spill area will be kept well ventilated, and personnel will wear protective clothing to prevent injury from contact with a hazardous substance.
- e) Spills of toxic or hazardous material in excess of reportable quantities, as established in the Massachusetts Contingency Plan (MCP), will be reported to the Massachusetts Department of Environmental Protection Division of Hazardous Waste [617) 292-5851 or (978) 661-7679].
- f) The construction superintendent responsible for the daily operations will be the spill prevention and cleanup coordinator. He will designate at least three other project area personnel to receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of the

responsible spill personnel will be posted in the material storage area and in the on-site office trailer.

Lawn Care & Landscaping

All lawn clippings, leaves, mulch, and any other landscaping items shall be kept out of storm drains. The use of pesticides and fertilizers on the lawn shall never be applied before a rain event. Only approved aquatic safe herbicides shall be allowed. The application of any fertilizers or pesticides shall be in accordance with the Manufacturer's specifications.

Vehicle Washing

No harmful soaps or chemicals that are detrimental to the environment may be used in washing of cars or other items on the property.

Pet Waste Collection

Pet owners shall be responsible for picking up and disposing of all pet waste into waste containers.

Waste Collection

All trash and waste shall be placed in the dumpster on site. The cover to the dumpster shall remain closed at all times. Any trash or debris found on site shall be disposed of in the dumpster. Regular pickup of the dumpster shall occur to avoid the waste exceeding the dumpster capacity.

Street Sweeping

The driveway, parking lot, sidewalks, and patios shall be swept every spring season after the last snowfall. All sediment shall be removed and discarded off the property in accordance with all Local, State and Federal regulations.

Training

The individual who will be responsible for the inspection and maintenance of the stormwater system shall be trained by the previous person responsible or by contacting a local engineer for assistance.