

# **Drainage Report**

## **Project:**

### **COMPASS PARK – INDIANA MASONIC HOME ROAD EXTENSION AND IMPROVEMENT**

690 State Street  
Franklin, Indiana 46131

## **Prepared For:**

### **Compass Park Indiana Masonic Home**

690 State Street  
Franklin, IN 46131

## **Prepared By:**

### **CIVIL & ENVIRONMENTAL CONSULTANTS, INC.**

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**CEC Project 180-416**

**JUNE 2018**



*Robert L. Gaffer*  
a/6/18



Civil & Environmental Consultants, Inc.

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## 1.0 REPORT OVERVIEW

This report establishes the stormwater quantity and quality requirements for the proposed Compass Park Road Extension and Improvement Project located at 690 State Street in Franklin, Indiana. The site is currently made of several buildings on campus. These structures include a community center and several residences, to name a few. The proposed improvements include widening the existing entrance off of East South Street. This widened and improved road will extend to the south to the recently constructed parking lots for the community center. The new drive will include additional parking lots along the length of the road. Necessary utilities that will be required for future structures at the site west side of Red Skelton Drive will be provided as well.

## 2.0 PROJECT BACKGROUND

### 2.1 EXISTING CONDITIONS

The project site is located on the west half of the Indiana Masonic Home campus, just east of Young's Creek. The campus is located in zone X on the FEMA map. The existing site is broken into 3 separate areas of interest for drainage analysis. The North Basin is 0.571 Acres. Due to difficulties in elevation, it cannot be directed to a detention facility in proposed conditions. Therefore it will be directed to sheet flow as in the existing conditions, Young's Creek. The area of the North Basin that will not be detained will be substituted in the Central Basin by detaining the existing impervious area as well as the proposed improvements. The Central Basin is 1.072 Acres and contains two residential structures that will be removed in order to extend and widen the road. The South Basin is 2.364 Acres. The development of this basin is taken into account in a previous development with the Community Center. The existing flow rates are shown in Table 1. The existing drainage map *Figure C-1* can be seen in **Appendix C**. Portions of previous drainage report showing the South Basin can be seen in **Appendix H**.

**Table 1: Existing Discharge Rates**

Existing Conditions Peak Runoff Rate (cfs)			
Storm Event	2-Year	10-Year	100-Year
Central Basin	3.93	7.14	11.17

Table 1 above displays the existing peak runoff rates from the Central Basin.

#### 2.1.1 FEMA Map

The project site is located within the FEMA Community Panel Map # 18081C0231D dated August 2, 2007 which indicates the site is located within the Flood Designation 'Zone X, Area of Minimal Flood Hazard (No Shading)'. The FEMA Map is included in **Appendix A**.



### **2.1.2 Watershed Description**

The project site is located within the Youngs Creek – Buckhart Creek watershed as provided on the [IndianaMap](#) GIS system. The 14-digit Hydrologic Unit Code (HUC) of 05120204090060.

### **2.1.3 Soils Map**

The approximate limits of each soil type are depicted in the Soils Map provided in **Appendix B**.

## **3.0 STORMWATER DESIGN**

### **3.1 PROPOSED CONDITIONS**

This proposed project will construct a road extension and widening of the entrance road off of East South Street. The road will be completely removed and replaced in the same general area, although not exactly the same location. The widening will be approximately 4 feet. This widening will make the road width 24 feet. As stated previously, the north basin will directly convey runoff to Young's Creek. The area of improved impervious in the north area that will not be detained will be substituted in the Central Basin by detaining both the improved and existing impervious areas. The South Basin is accounted for in the drainage plan for the Community Center. The Central Basin considers future buildings and pavement for the detention. The calculation sheet showing these areas is shown in **Appendix C**. See proposed conditions on *Figure C-2* in **Appendix C**. See portions of the Community Center drainage plan in **Appendix H**.

The site will collect rainfall runoff with a series of catch basin inlets, mechanically treat contents with a water quality BMP, and detain excess water in the underground detention before discharging to Young's Creek.

### **3.2 WATER QUALITY**

#### **3.2.1 BMP Structures**

The Central Basin will utilize a mechanical BMP structure to treat runoff from the proposed site. The peak discharge during the 2 year, 24 hour storm event was determined to be 5.40 cfs for the site. This flow is designed to accommodate future building flow. To accommodate this flow, an Aqua-Swirl AS-6 offline model (capacity of 6.30 cfs) will be placed just upstream of the detention system. A diversion structure, connected to the Aqua Swirl unit, will contain a 0.92-foot tall weir to direct inflow to the Aqua Swirl before continuing to the downstream detention facility.

#### **3.2.2 Treatment Rate Determination**

Water quality for the site was determined by using the maximum flow rate from the proposed conditions during the 2 year 24 hour storm event. The peak flow from this event resulted in 5.40 cfs. Data was calculated with a HydroCAD simulation (see **Appendix G**).

### 3.3 STORMWATER MANAGEMENT

#### 3.3.1 Hydraulic Performance

In order to mitigate the peak flow leaving the proposed site, a detention system of 60 ADS StormTech SC-310 chambers will store water before releasing it to the existing storm sewer network. The maximum allowable peak runoff rate is constrained to meet the criteria outlined in section 302.03 of the City of Indianapolis Stormwater Manual. The results are presented below in Table 2. Table 3 below compares existing and proposed runoff rates.

**Table 2: Proposed Discharge Rates**

<b>Proposed Conditions Peak Runoff Rate (cfs)</b>			
<u>Storm Event</u>	<u>2-Year</u>	<u>10-Year</u>	<u>100-Year</u>
Central Basin	2.64	3.79	7.01

Table 2 above displays the proposed peak runoff rates from the Central Basin. Full proposed HydroCAD reports can be seen in **Appendix F**.

**Table 3: Existing and Proposed Discharge Rates**

<b>Existing and Proposed Conditions Peak Runoff Rate (cfs)</b>			
<u>Condition</u>	<u>2-Year</u>	<u>10-Year</u>	<u>100-Year</u>
Existing Central Basin	3.93	7.14	11.17
Proposed Central Basin	2.64	3.79	7.01

#### 3.3.2 Outlet Control Structure

To achieve the allowable rates shown in Table 2, an outlet control structure will include a 11.0” diameter orifice at 719.00’, and 10.5” diameter orifice at 720.88’. A weir with top elevation at 721.84. In total, the proposed detention system has a peak storage of 0.152 acre-feet of water (6636 cubic-feet).

#### 3.3.3 Runoff Curve Number (CN) Determination

For impervious areas such as buildings and pavement, a CN value of 98 was used. Areas with exposed subgrade and grass cover were modeled using a CN of 80 because the site is classified as “C/D” soils. These values were chosen based on the 320-VI-TR-55 reference table. The time of concentration was assumed to be a minimum allowable of 5 minutes for paved inlets, and all pipes were assigned a Manning’s coefficient “n” value of 0.013. Refer to storm sewer calculations in **Appendix D**.

#### 3.3.4 Computer Software

The hydrology and detention pond design calculations were performed using HydroCAD v10.00 (by HydroCAD Software Solutions LLC) computer software. The City of Indianapolis Stormwater Specifications Manual rainfall depths were used to develop the final hydrographs.

#### **4.0 CONCLUSION**

The proposed road extension and widening project on Compass Park – Indiana Masonic Homes will be served with adequate detention and water quality facilities in accordance with the City of Franklin Subdivision Control Ordinance. Due to the proposed drainage system and water quality unit, no adverse impacts are expected for upstream or downstream property owners.

#### **5.0 REFERENCES**

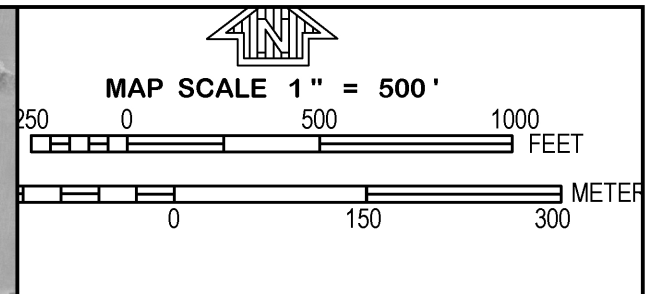
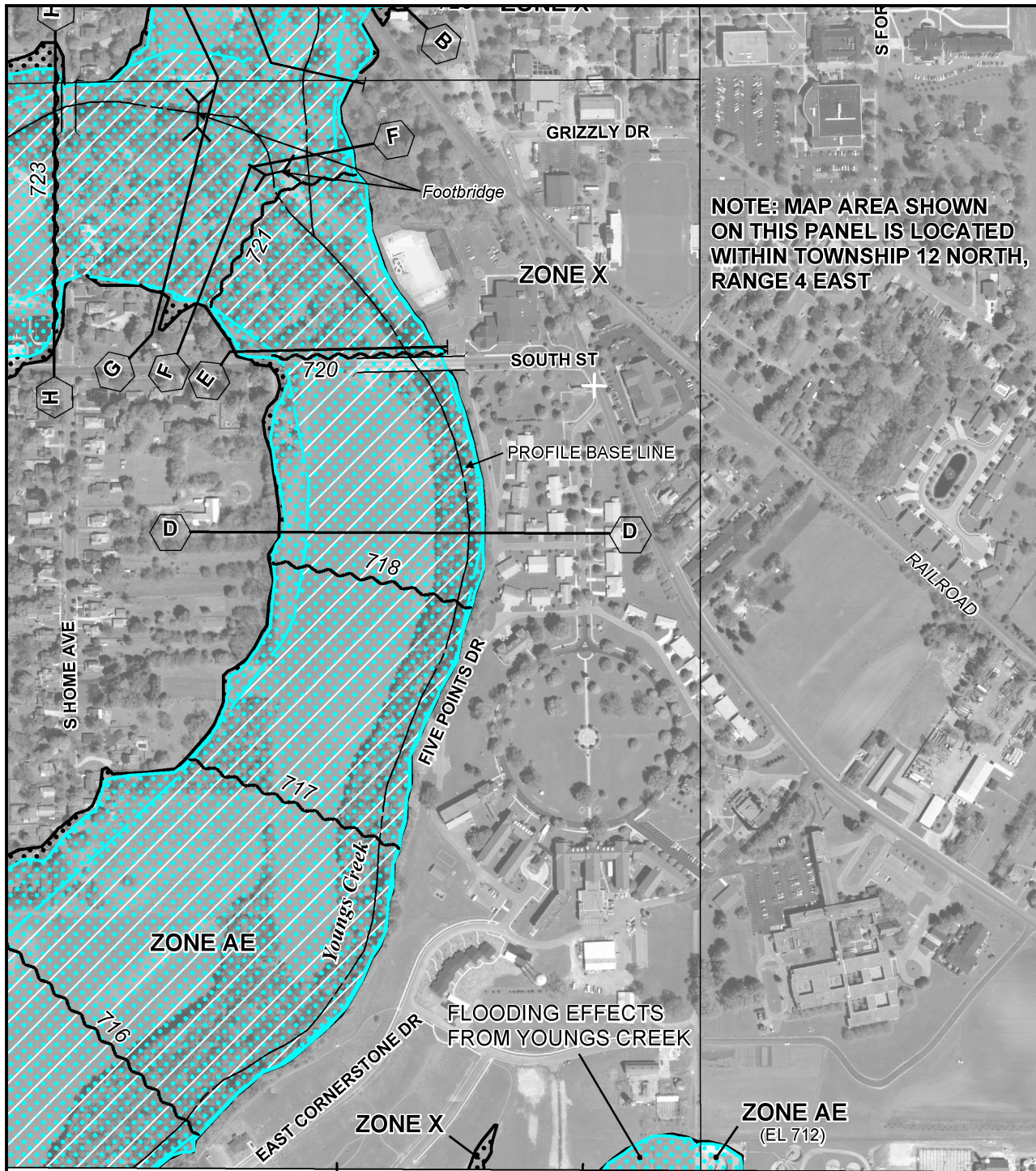
1. Johnson County Soils Map
2. FEMA Flood Insurance Rate Maps, FEMA website
3. City of Franklin Subdivision Control Ordinance

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**APPENDIX A**  
**FEMA FIRM RATE MAP**

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NFIP  
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0231D

**FIRM**  
FLOOD INSURANCE RATE MAP  
JOHNSON COUNTY,  
INDIANA  
AND INCORPORATED AREAS

**PANEL 231 OF 352**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FRANKLIN, CITY OF	180114	0231	D
JOHNSON COUNTY	180111	0231	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



**MAP NUMBER**  
**18081C0231D**  
**EFFECTIVE DATE**  
**AUGUST 2, 2007**

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

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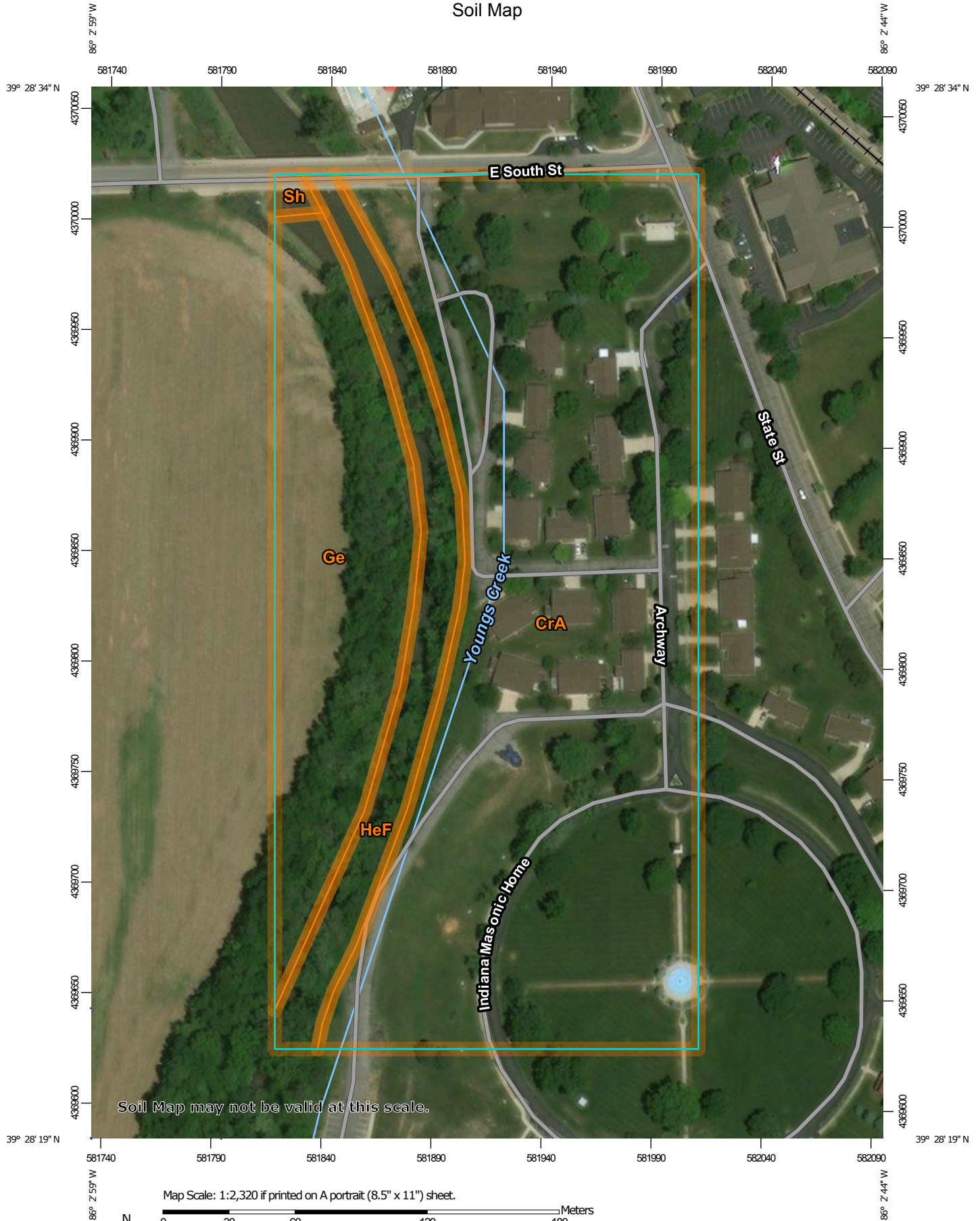
## **APPENDIX B**

### **SOILS MAP**

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# Custom Soil Resource Report Soil Map



# Custom Soil Resource Report


## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

### Water Features

 Streams and Canals

### Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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: Johnson County, Indiana  
Survey Area Data: Version 25, Oct 2, 2017

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

Date(s) aerial images were photographed: Sep 24, 2014—Mar 20, 2017

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



## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CrA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	12.9	68.4%
Ge	Genesee loam	4.0	21.0%
HeF	Hennepin loam, 25 to 50 percent slopes	1.9	10.2%
Sh	Shoals silt loam	0.1	0.4%
<b>Totals for Area of Interest</b>		<b>18.9</b>	<b>100.0%</b>

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## Johnson County, Indiana

### CrA—Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2thy4  
*Elevation:* 600 to 1,000 feet  
*Mean annual precipitation:* 36 to 44 inches  
*Mean annual air temperature:* 49 to 54 degrees F  
*Frost-free period:* 145 to 180 days  
*Farmland classification:* Prime farmland if drained

#### Map Unit Composition

*Crosby and similar soils:* 93 percent  
*Minor components:* 7 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Crosby

##### Setting

*Landform:* Ground moraines, recessional moraines, water-lain moraines  
*Landform position (two-dimensional):* Summit, backslope, footslope  
*Landform position (three-dimensional):* Interfluve, rise  
*Down-slope shape:* Convex, linear  
*Across-slope shape:* Linear, convex  
*Parent material:* Silty material or loess over loamy till

##### Typical profile

*Ap - 0 to 10 inches:* silt loam  
*Btg - 10 to 17 inches:* silty clay loam  
*2Bt - 17 to 29 inches:* clay loam  
*2BCt - 29 to 36 inches:* loam  
*2Cd - 36 to 79 inches:* loam

##### Properties and qualities

*Slope:* 0 to 2 percent  
*Depth to restrictive feature:* 24 to 40 inches to densic material  
*Natural drainage class:* Somewhat poorly drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* Low to moderately high (0.01 to 0.20 in/hr)  
*Depth to water table:* About 6 to 24 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 55 percent  
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Available water storage in profile:* Moderate (about 6.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 2w  
*Hydrologic Soil Group:* C/D  
*Hydric soil rating:* No

## Minor Components

### Williamstown, eroded

*Percent of map unit:* 5 percent

*Landform:* Ground moraines, recessional moraines, water-lain moraines

*Landform position (two-dimensional):* Summit, shoulder, backslope

*Landform position (three-dimensional):* Crest, head slope, nose slope, side slope, rise

*Down-slope shape:* Convex, linear

*Across-slope shape:* Linear, convex

*Hydric soil rating:* No

### Treaty, drained

*Percent of map unit:* 2 percent

*Landform:* Depressions, swales, water-lain moraines

*Landform position (two-dimensional):* Toeslope, footslope

*Landform position (three-dimensional):* Base slope, dip

*Down-slope shape:* Linear

*Across-slope shape:* Concave

*Hydric soil rating:* Yes

## Ge—Genesee loam

### Map Unit Setting

*National map unit symbol:* 5f70

*Elevation:* 680 to 1,020 feet

*Mean annual precipitation:* 36 to 42 inches

*Mean annual air temperature:* 49 to 53 degrees F

*Frost-free period:* 175 to 185 days

*Farmland classification:* Prime farmland if protected from flooding or not frequently flooded during the growing season

### Map Unit Composition

*Genesee and similar soils:* 100 percent

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

### Description of Genesee

#### Setting

*Landform:* Flood plains

*Landform position (two-dimensional):* Summit

*Landform position (three-dimensional):* Interfluvium

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Loamy alluvium

#### Typical profile

*H1 - 0 to 8 inches:* loam

*H2 - 8 to 40 inches:* silt loam

*H3 - 40 to 60 inches:* stratified loamy sand to sandy loam

**Properties and qualities**

*Slope:* 0 to 2 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Well drained  
*Runoff class:* Very low  
*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:* About 48 to 72 inches  
*Frequency of flooding:* Frequent  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 30 percent  
*Available water storage in profile:* Very high (about 12.1 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 2w  
*Hydrologic Soil Group:* B  
*Other vegetative classification:* Trees/Timber (Woody Vegetation)  
*Hydric soil rating:* No

**HeF—Hennepin loam, 25 to 50 percent slopes**

**Map Unit Setting**

*National map unit symbol:* 2w0vj  
*Elevation:* 510 to 1,150 feet  
*Mean annual precipitation:* 37 to 45 inches  
*Mean annual air temperature:* 48 to 55 degrees F  
*Frost-free period:* 145 to 180 days  
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Hennepin and similar soils:* 90 percent  
*Minor components:* 10 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Hennepin**

**Setting**

*Landform:* Till plains  
*Landform position (two-dimensional):* Backslope  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Loamy till

**Typical profile**

*A - 0 to 3 inches:* loam  
*Bw - 3 to 14 inches:* loam  
*C - 14 to 60 inches:* loam

**Properties and qualities**

*Slope:* 25 to 50 percent

## Custom Soil Resource Report

*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Well drained  
*Runoff class:* Very high  
*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:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 40 percent  
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Available water storage in profile:* Low (about 3.5 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 7e  
*Hydrologic Soil Group:* C  
*Hydric soil rating:* No

### Minor Components

#### Miami, eroded

*Percent of map unit:* 10 percent  
*Landform:* Ground moraines, recessional moraines, water-lain moraines  
*Landform position (two-dimensional):* Summit, shoulder, backslope  
*Landform position (three-dimensional):* Side slope, crest, head slope, nose slope, rise  
*Down-slope shape:* Convex, linear  
*Across-slope shape:* Linear, convex  
*Hydric soil rating:* No

## Sh—Shoals silt loam

### Map Unit Setting

*National map unit symbol:* 5f7q  
*Elevation:* 680 to 1,020 feet  
*Mean annual precipitation:* 36 to 42 inches  
*Mean annual air temperature:* 49 to 53 degrees F  
*Frost-free period:* 175 to 185 days  
*Farmland classification:* Prime farmland if drained

### Map Unit Composition

*Shoals and similar soils:* 90 percent  
*Minor components:* 10 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Shoals

#### Setting

*Landform:* Flood plains

## Custom Soil Resource Report

*Landform position (two-dimensional):* Summit  
*Landform position (three-dimensional):* Interfluve  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Loamy alluvium

### Typical profile

*H1 - 0 to 8 inches:* silt loam  
*H2 - 8 to 35 inches:* silt loam  
*H3 - 35 to 60 inches:* stratified silt loam to sandy loam to loam

### Properties and qualities

*Slope:* 0 to 2 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Somewhat poorly drained  
*Runoff class:* Negligible  
*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:* About 6 to 24 inches  
*Frequency of flooding:* Frequent  
*Frequency of ponding:* None  
*Calcium carbonate, maximum in profile:* 30 percent  
*Available water storage in profile:* High (about 11.5 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 2w  
*Hydrologic Soil Group:* B/D  
*Other vegetative classification:* Trees/Timber (Woody Vegetation)  
*Hydric soil rating:* No

### Minor Components

#### Poorly drained aquents

*Percent of map unit:* 7 percent  
*Landform:* Drainageways  
*Other vegetative classification:* Trees/Timber (Woody Vegetation)  
*Hydric soil rating:* Yes

#### Sloan

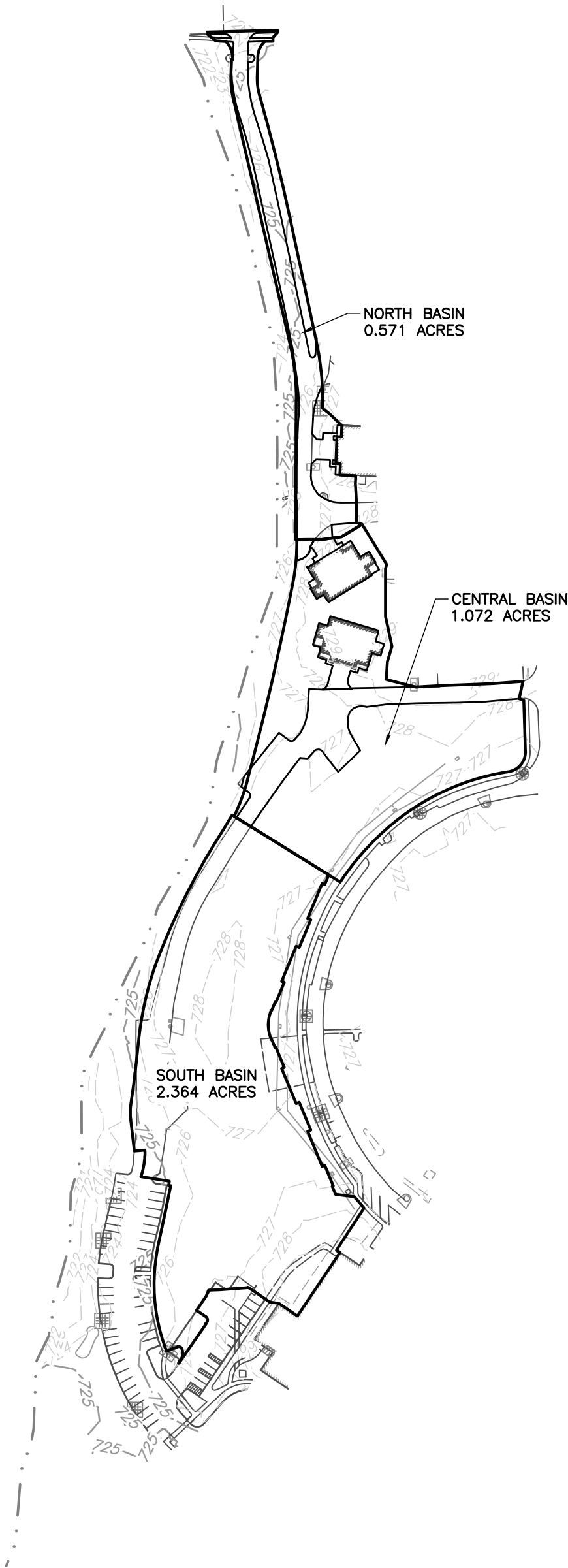
*Percent of map unit:* 3 percent  
*Landform:* Drainageways  
*Other vegetative classification:* Mixed/Transitional (Mixed Native Vegetation)  
*Hydric soil rating:* Yes

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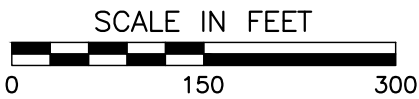
**APPENDIX C**  
**EXISTING & PROPOSED WATERSHED MAPS**


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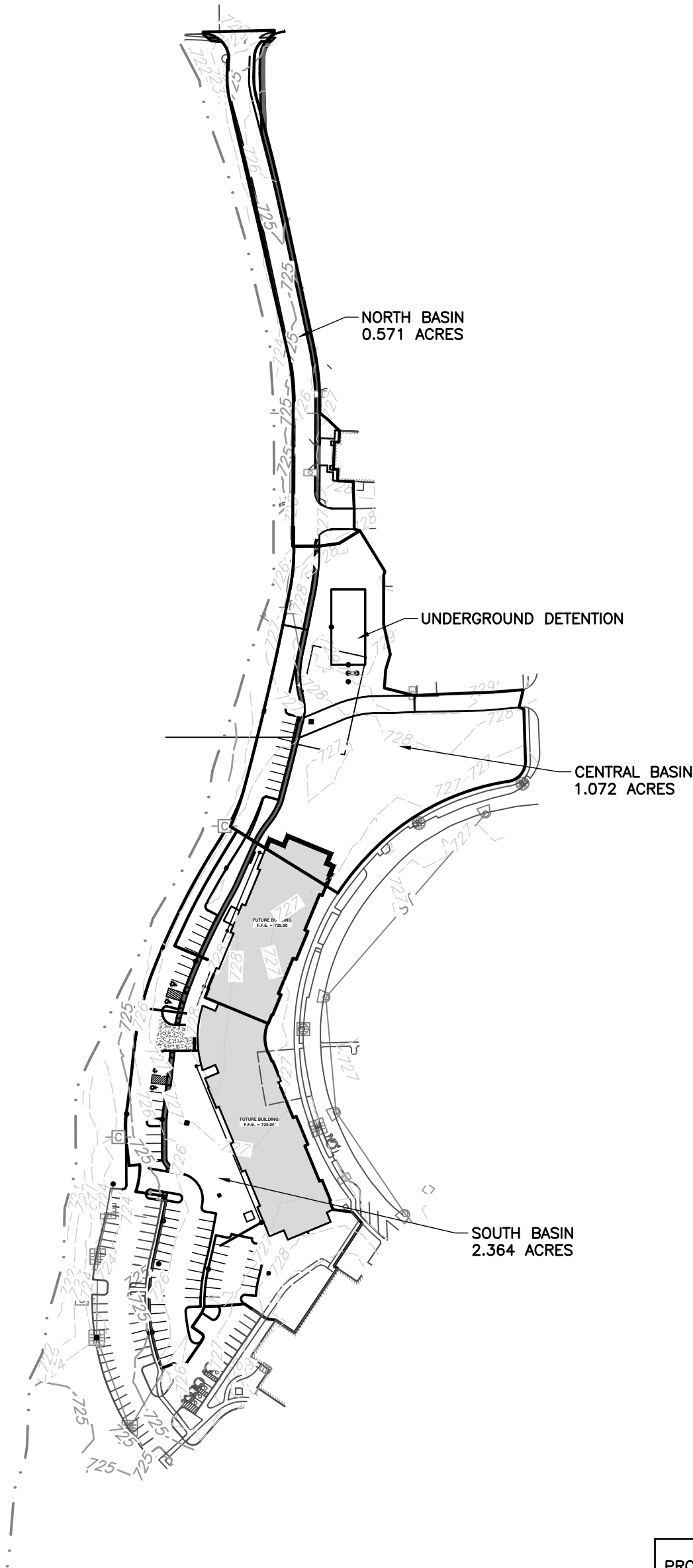




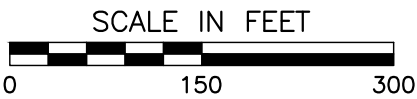
CENTRAL BASIN  
EXISTING SITE = 75649 SF  
PERVIOUS = -54081 SF  
IMPERVIOUS = 21568 SF




<div> <b>Civil &amp; Environmental Consultants, Inc.</b> 530 E. Ohio Street, Suite G - Indianapolis, IN 46204 317-655-7777 · 877-746-0749 www.cecinc.com</div>				COMPASS PARK INDIANA MASONIC HOME 690 STATE STREET FRANKLIN, INDIANA 46131		
				OVERALL EXISTING SITE MAP		
DRAWN BY:	EAJ	CHECKED BY:	DRAFT	APPROVED BY:	DRAFT	FIGURE NO.:
DATE:	JUNE 5, 2018	DWG SCALE:	1"= 150'	PROJECT NO:	180-416	<b>C-1</b>



CENTRAL BASIN  
PROPOSED SITE = -75649 SF  
PERVIOUS = 42753 SF  
IMPERVIOUS = 32896 SF

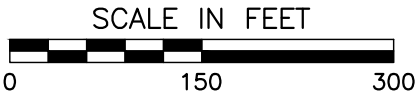
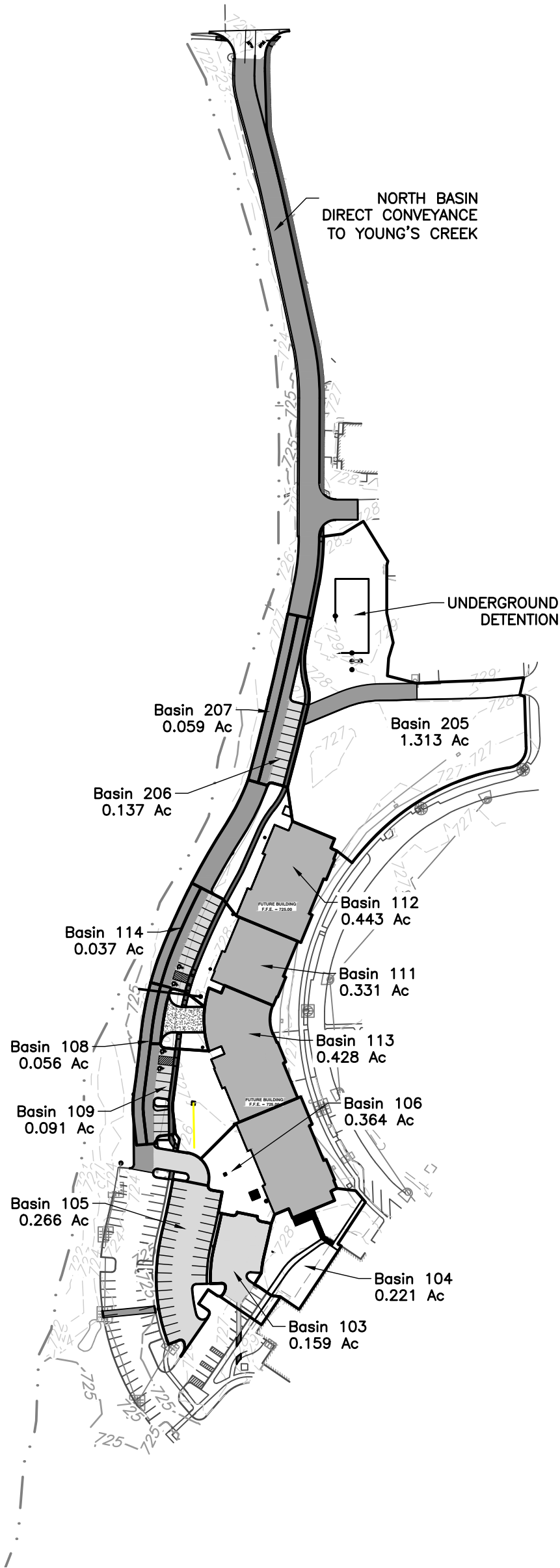



<div> <b>Civil &amp; Environmental Consultants, Inc.</b> 530 E. Ohio Street, Suite G - Indianapolis, IN 46204 317-655-7777 · 877-746-0749 www.cecinc.com</div>				COMPASS PARK INDIANA MASONIC HOME 690 STATE STREET FRANKLIN, INDIANA 46131		
				PROPOSED BASIN MAP		
DRAWN BY: EAJ		CHECKED BY: DRAFT		APPROVED BY: DRAFT		FIGURE NO.:
DATE: JUNE 5, 2018		DWG SCALE: 1"=150'		PROJECT NO: 180-416		<b>C-2</b>

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**APPENDIX D**  
**STORM SEWER SIZING CALCULATIONS**

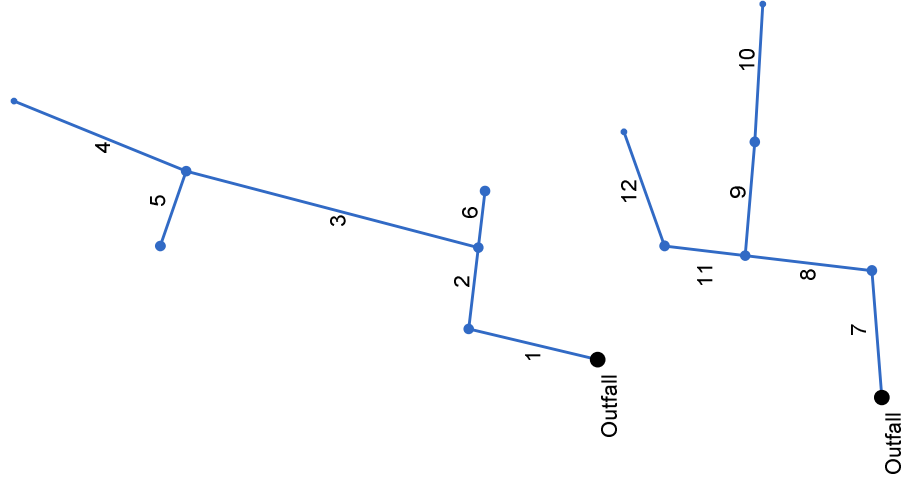
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<div> <b>Civil &amp; Environmental Consultants, Inc.</b> 530 E. Ohio Street, Suite G - Indianapolis, IN 46204 317-655-7777 · 877-746-0749 www.cecinc.com</div>				COMPASS PARK INDIANA MASONIC HOME 690 STATE STREET FRANKLIN, INDIANA 46131		
				PROPOSED INLET MAP		
DRAWN BY: EAJ		CHECKED BY: DRAFT		APPROVED BY: DRAFT		FIGURE NO.:
DATE: JUNE 5, 2018		DWG SCALE: 1"=150'		PROJECT NO: 180-416		<b>C-3</b>

Civil & Environmental Consultants, Inc.						
					By:	rlg
Project Name:	Compass Park - Indiana Masonic Home				Date:	6/6/18
CEC Project No.:	180-416				Checked By:	
Description:	Composite C Calculations				Date:	
Runoff Coefficient						
	Roof Surfaces=	0.90				
	Pavement=	0.85				
	Gravel/Stone =	0.85				
	Pervious=	0.25				
<b>BASINS</b>						
<b>STR 103</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	6,382	0	530	6,912	0.16	0.80
<b>STR 104</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	1,434	0	8,225	9,659	0.22	0.34
<b>STR 105</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	10,438	0	1,154	11,592	0.27	0.79
<b>STR 106</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
10,209	100	0	5,530	15,839	0.36	0.67
<b>STR 108</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	2,421	0	0	2,421	0.06	0.85
<b>STR 109</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	3,704	0	243	3,947	0.09	0.81
<b>STR 111</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
6,507	5,214	0	2,683	14,404	0.33	0.76
<b>STR 112</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
10,209	4,482	0	4,615	19,306	0.44	0.73

Civil & Environmental Consultants, Inc.						
					By:	rlg
Project Name:	Compass Park - Indiana Masonic Home				Date:	6/6/18
CEC Project No.:	180-416				Checked By:	
Description:	Composite C Calculations				Date:	
Runoff Coefficient						
	Roof Surfaces=	0.90				
	Pavement=	0.85				
	Gravel/Stone =	0.85				
	Pervious=	0.25				
<b>BASINS</b>						
<b>STR 113</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
11,440	0	0	7,207	18,647	0.43	0.65
<b>STR 114</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	1,602	0	0	1,602	0.04	0.85
<b>STR 205</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
20,016	20,015	0	17,156	57,187	1.31	0.69
<b>STR 206</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	5,436	0	530	5,966	0.14	0.80
<b>STR 207</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	2,572	0	0	2,572	0.06	0.85
<b>STR Trench Drain</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
0	1,811	0	1,428	3,239	0.07	0.59
					Total Site "C"	0.70
<b>Trench Drain &amp; STR 113</b>						
Roof	Pavement	Gravel/Stone	Lawn	Total	Total	Composite
(ft^2)	(ft^2)	(ft^2)	(ft^2)	(ft^2)	(Acres)	"C"
11,440	1,811	0	8,635	21,886	0.50	0.64



# Storm Sewer Tabulation

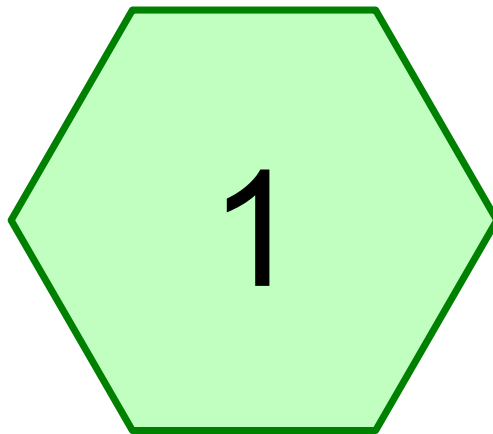
Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	84.014	0.06	1.46	0.85	0.05	1.05	5.0	11.2	5.4	5.67	6.17	3.96	18	0.35	721.45	721.74	722.58	722.87	724.16	724.57	22
2	1	42.500	0.09	1.40	0.81	0.07	1.00	5.0	11.0	5.4	5.44	5.81	3.43	18	0.31	721.84	721.97	723.12	723.22	724.57	724.79	24
3	2	190.783	0.33	0.81	0.76	0.25	0.61	5.0	7.2	6.5	3.91	5.74	2.69	18	0.30	722.07	722.64	723.41	723.67	724.79	725.35	26
4	3	115.770	0.44	0.44	0.73	0.32	0.32	5.0	5.0	7.3	2.33	3.55	2.33	15	0.30	722.74	723.09	723.81	723.95	725.35	725.13	30
5	3	42.000	0.04	0.04	0.85	0.03	0.03	5.0	5.0	7.3	0.25	2.13	0.32	12	0.36	722.74	722.89	723.81	723.81	725.35	725.15	34
6	2	29.500	0.50	0.50	0.64	0.32	0.32	10.6	10.6	5.5	1.77	3.57	1.44	15	0.30	722.07	722.16	723.41	723.41	724.79	724.60	32
7	End	65.830	0.00	1.01	0.00	0.00	0.66	0.0	7.3	6.4	4.23	6.21	3.77	18	0.35	718.94	719.17	719.85	720.08	723.69	723.69	11
8	7	81.217	0.00	1.01	0.00	0.00	0.66	0.0	6.9	6.6	4.31	5.71	3.42	18	0.30	719.27	719.51	720.30	720.50	723.69	721.95	13
9	8	58.967	0.16	0.38	0.80	0.13	0.20	5.0	6.3	6.8	1.37	2.13	1.76	12	0.36	719.61	719.82	720.69	720.77	721.95	722.09	17
10	9	71.338	0.22	0.22	0.34	0.07	0.07	5.0	5.0	7.3	0.54	2.11	0.91	12	0.35	719.92	720.17	720.78	720.79	722.09	722.34	19
11	8	51.780	0.27	0.63	0.79	0.21	0.45	5.0	5.5	7.1	3.21	3.81	2.94	15	0.35	719.61	719.79	720.69	720.80	721.95	722.06	15
12	11	64.309	0.36	0.36	0.67	0.24	0.24	5.0	5.0	7.3	1.75	2.13	2.25	12	0.36	719.89	720.12	720.92	721.07	722.06	721.78	55
13	End	10.000	0.00	1.51	0.00	0.00	1.07	0.0	7.1	6.5	6.93	12.39	4.06	24	0.30	721.50	721.53	722.57	722.60	724.75	724.88	43
14	13	10.000	0.00	1.51	0.00	0.00	1.07	0.0	7.0	6.5	6.94	12.38	4.05	24	0.30	721.63	721.66	722.70	722.73	724.88	725.01	45
15	14	64.383	1.31	1.51	0.69	0.90	1.07	5.0	6.7	6.6	7.04	12.29	3.84	24	0.30	721.76	721.95	722.92	723.06	725.01	725.30	47
16	15	15.000	0.14	0.20	0.80	0.11	0.16	5.0	6.5	6.7	1.09	3.73	0.90	15	0.33	722.05	722.10	723.27	723.28	725.30	724.95	49
17	16	42.005	0.06	0.06	0.85	0.05	0.05	5.0	5.0	7.3	0.37	2.13	0.48	12	0.36	722.20	722.35	723.28	723.28	724.95	725.10	51
Project File: 180416 Storm.stm														Number of lines: 17		Run Date: 6/6/2018						
NOTES:Intensity = 55.91 / (Inlet time + 8.50) ^ 0.78; Return period =Yrs. 10 ; c = cir e = ellip b = box																						



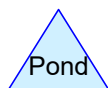
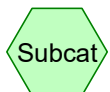
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**APPENDIX E**  
**EXISTING HYDROCAD OUTPUT**

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# Existing



**180-416 - Existing Revised 2018 05 14**

Prepared by CEC, Inc.

Printed 6/6/2018

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Page 2

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
1.242	74	>75% Grass cover, Good, HSG C (1)
0.495	98	Paved parking, HSG B (1)

### Summary for Subcatchment 1: Existing

Runoff = 3.16 cfs @ 11.97 hrs, Volume= 0.142 af, Depth= 0.98"

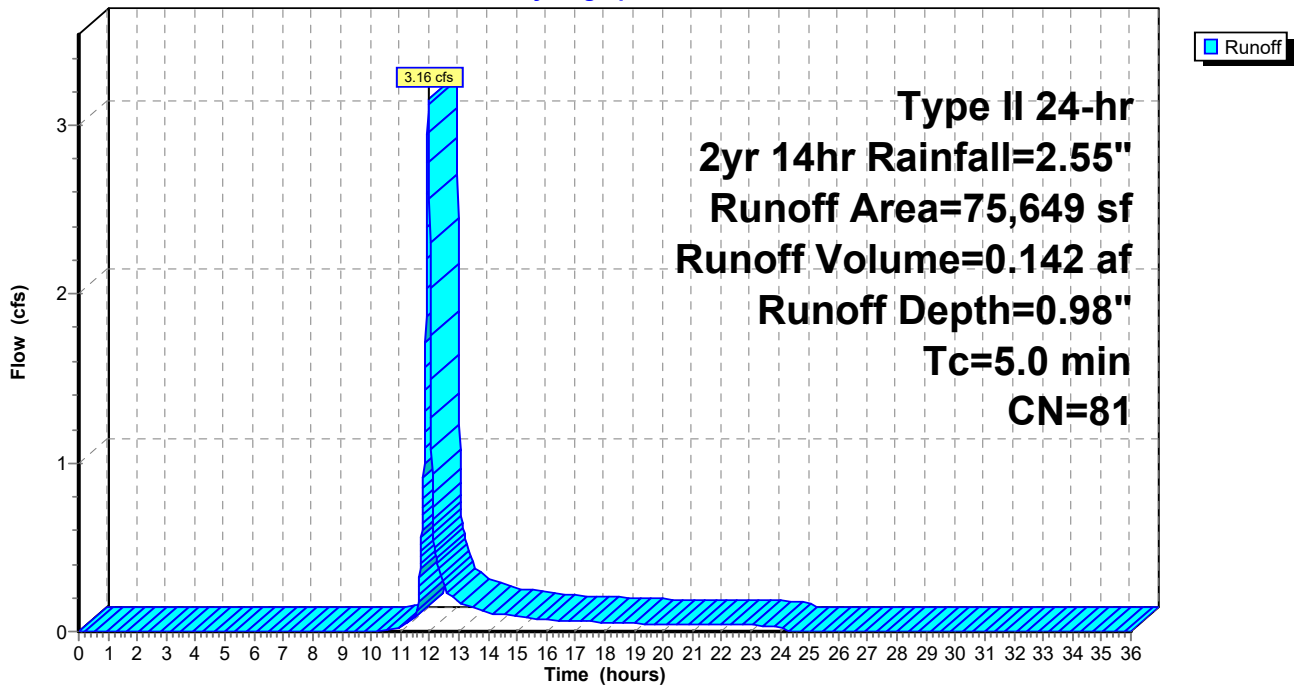
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 14hr Rainfall=2.55"

Area (sf)	CN	Description
21,568	98	Paved parking, HSG B
54,081	74	>75% Grass cover, Good, HSG C
75,649	81	Weighted Average
54,081		71.49% Pervious Area
21,568		28.51% Impervious Area

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

### Subcatchment 1: Existing

Hydrograph



### Summary for Subcatchment 1: Existing

Runoff = 3.93 cfs @ 11.96 hrs, Volume= 0.176 af, Depth= 1.21"

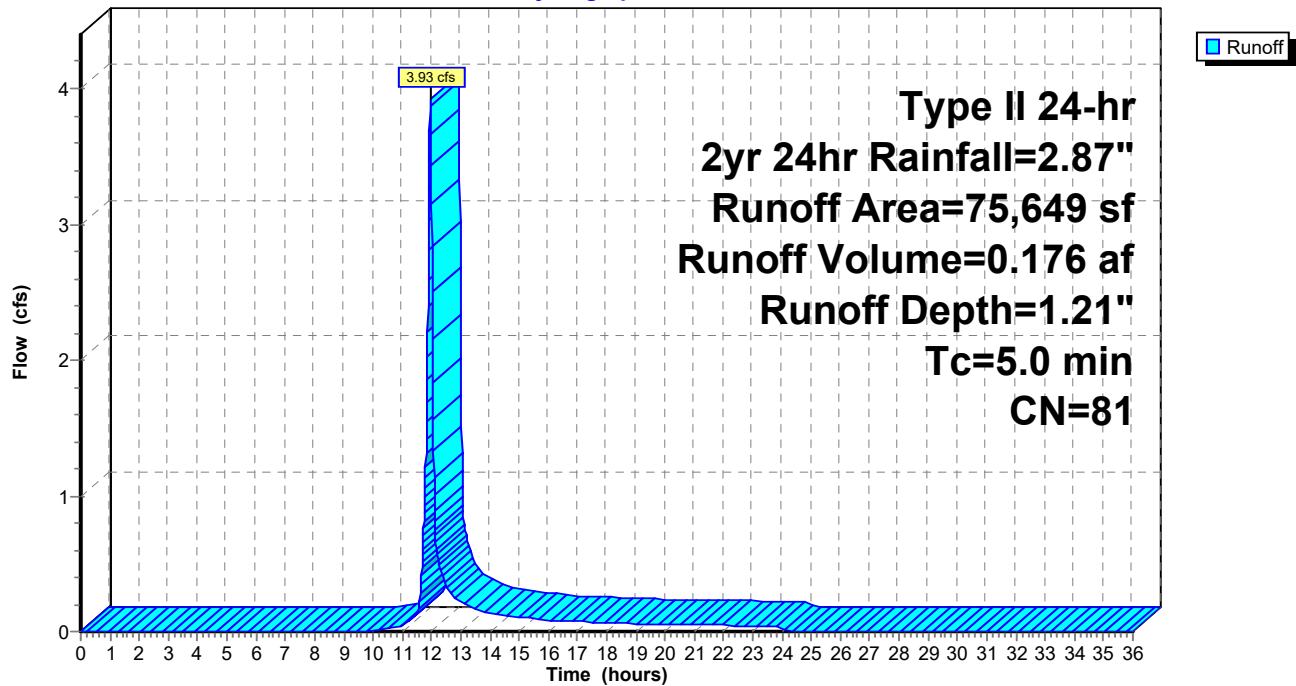
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 24hr Rainfall=2.87"

Area (sf)	CN	Description
21,568	98	Paved parking, HSG B
54,081	74	>75% Grass cover, Good, HSG C
75,649	81	Weighted Average
54,081		71.49% Pervious Area
21,568		28.51% Impervious Area

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

### Subcatchment 1: Existing

Hydrograph



### Summary for Subcatchment 1: Existing

Runoff = 5.94 cfs @ 11.96 hrs, Volume= 0.267 af, Depth= 1.85"

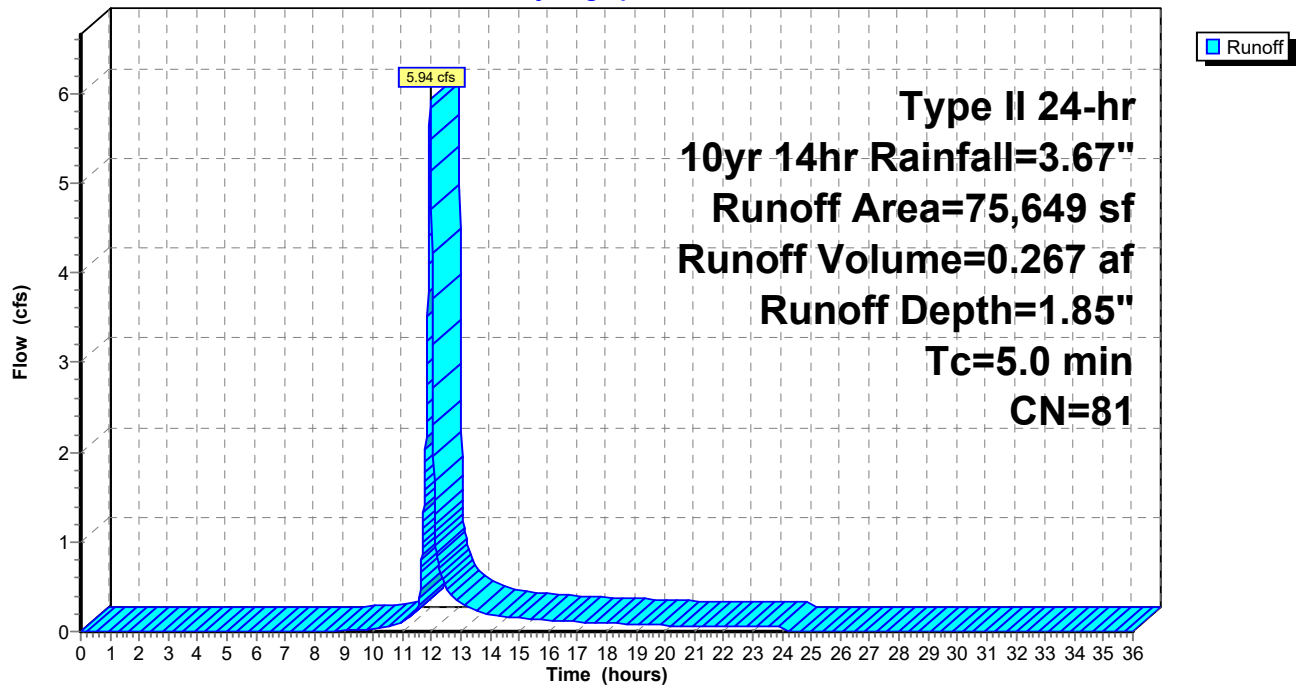
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10yr 14hr Rainfall=3.67"

Area (sf)	CN	Description
21,568	98	Paved parking, HSG B
54,081	74	>75% Grass cover, Good, HSG C
75,649	81	Weighted Average
54,081		71.49% Pervious Area
21,568		28.51% Impervious Area

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

### Subcatchment 1: Existing

Hydrograph



### Summary for Subcatchment 1: Existing

Runoff = 7.14 cfs @ 11.96 hrs, Volume= 0.323 af, Depth= 2.23"

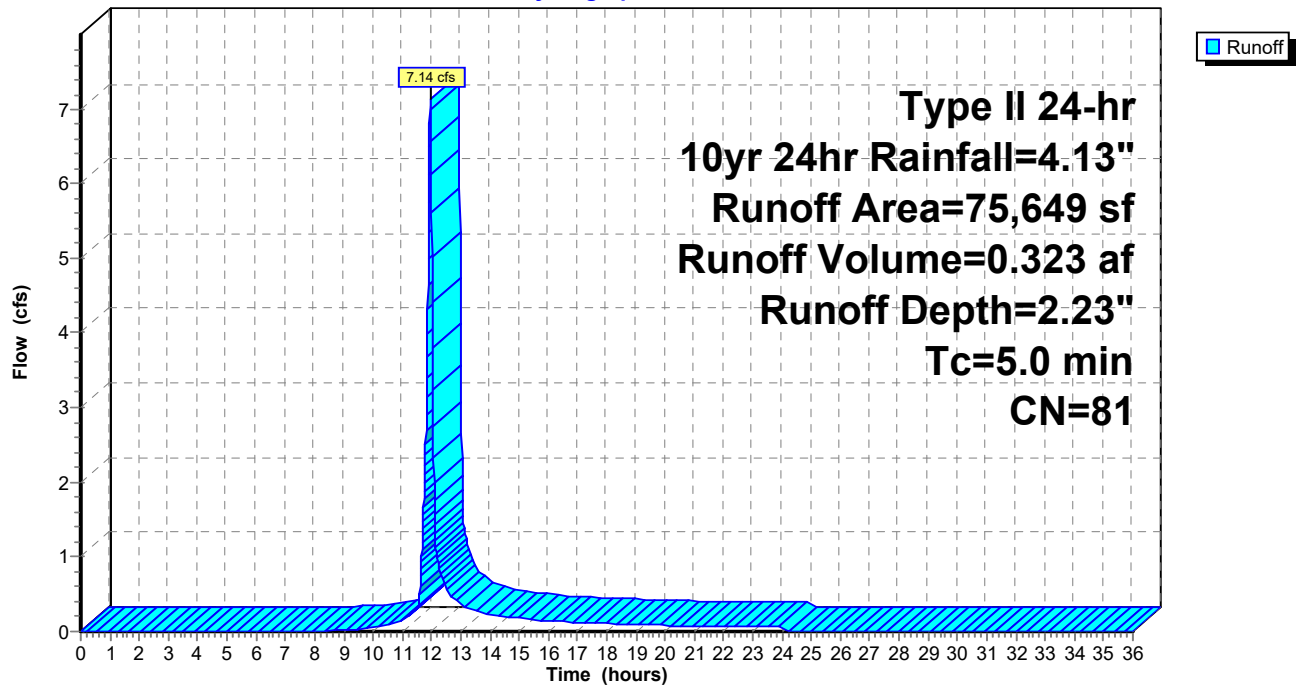
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs  
Type II 24-hr 10yr 24hr Rainfall=4.13"

Area (sf)	CN	Description
21,568	98	Paved parking, HSG B
54,081	74	>75% Grass cover, Good, HSG C
75,649	81	Weighted Average
54,081		71.49% Pervious Area
21,568		28.51% Impervious Area

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

### Subcatchment 1: Existing

Hydrograph



**Summary for Subcatchment 1: Existing**

Runoff = 9.51 cfs @ 11.96 hrs, Volume= 0.435 af, Depth= 3.00"

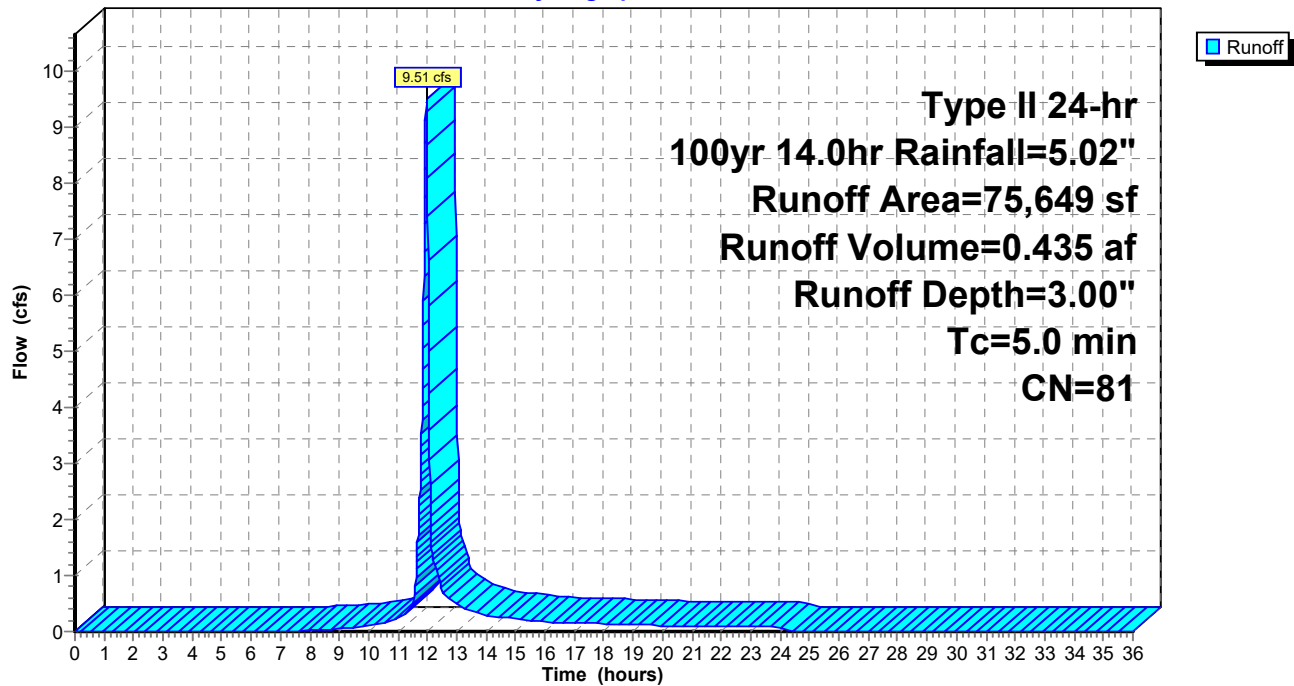
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100yr 14.0hr Rainfall=5.02"

Area (sf)	CN	Description
21,568	98	Paved parking, HSG B
54,081	74	>75% Grass cover, Good, HSG C
75,649	81	Weighted Average
54,081		71.49% Pervious Area
21,568		28.51% Impervious Area

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

**Subcatchment 1: Existing**

Hydrograph





**Summary for Subcatchment 1: Existing**

Runoff = 11.17 cfs @ 11.96 hrs, Volume= 0.515 af, Depth= 3.56"

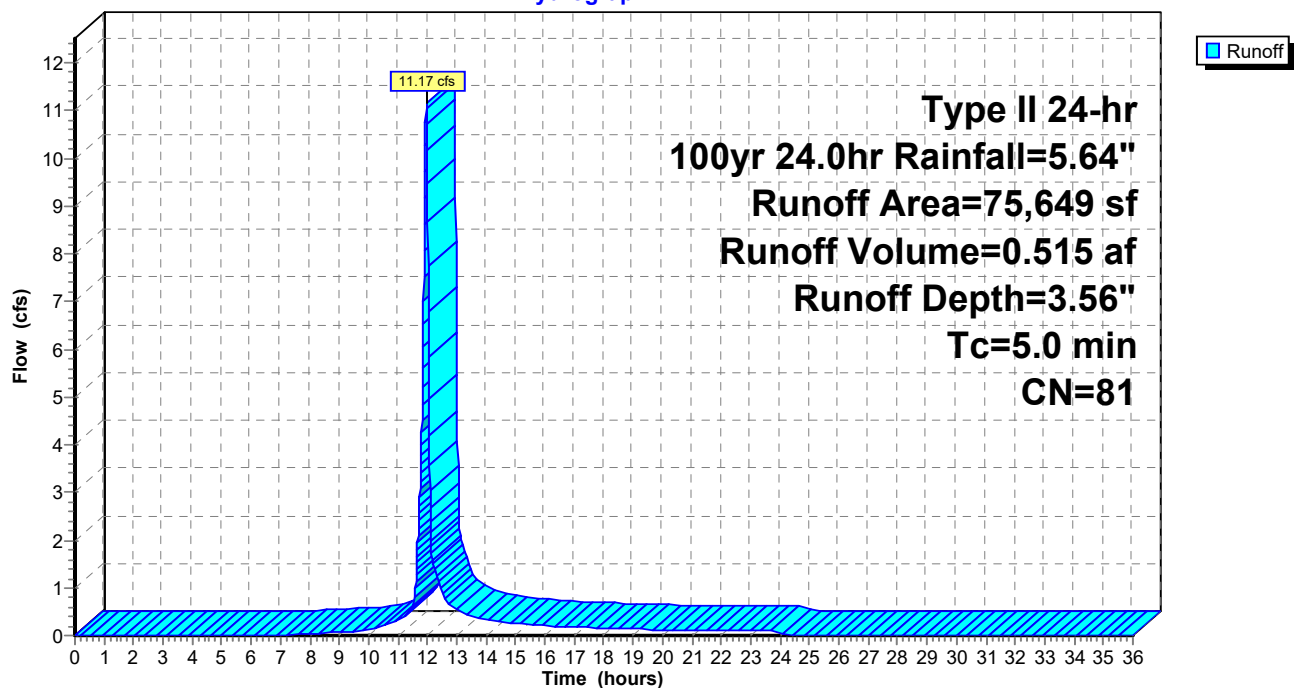
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs  
Type II 24-hr 100yr 24.0hr Rainfall=5.64"

Area (sf)	CN	Description
21,568	98	Paved parking, HSG B
54,081	74	>75% Grass cover, Good, HSG C
75,649	81	Weighted Average
54,081		71.49% Pervious Area
21,568		28.51% Impervious Area

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

**Subcatchment 1: Existing**

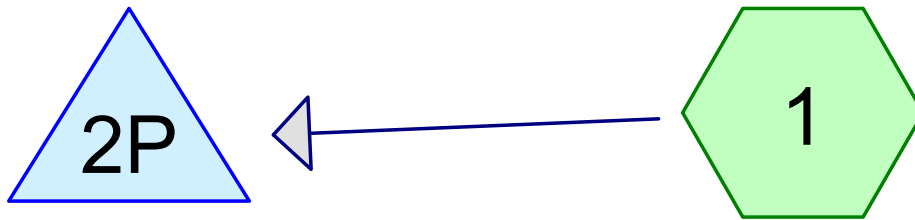
Hydrograph



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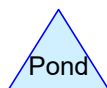
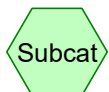
**APPENDIX F**  
**PROPOSED HYDROCAD OUTPUT**

---



UG Detention

Proposed



Routing Diagram for 180-416 - Proposed Reduced Basin Future Building 2018 05 14

Prepared by CEC, Inc., Printed 6/6/2018

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## 180-416 - Proposed Reduced Basin Future Building 2018 05 14

Prepared by CEC, Inc.

Printed 6/6/2018

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Page 2

### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.981	80	>75% Grass cover, Good, HSG D (1)
0.755	98	Paved parking, HSG B (1)

### Summary for Subcatchment 1: Proposed

Runoff = 4.55 cfs @ 11.96 hrs, Volume= 0.206 af, Depth= 1.42"

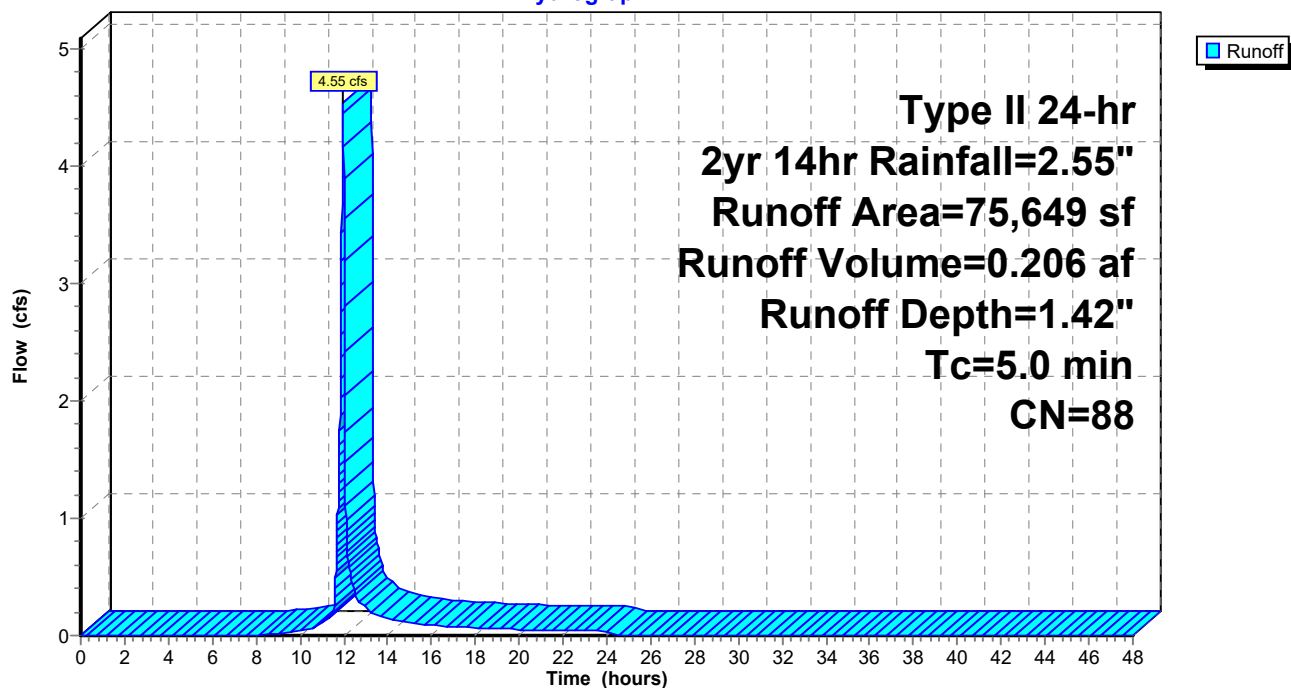
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 2yr 14hr Rainfall=2.55"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed

Hydrograph



### Summary for Pond 2P: UG Detention

Inflow Area = 1.737 ac, 43.49% Impervious, Inflow Depth = 1.42" for 2yr 14hr event  
 Inflow = 4.55 cfs @ 11.96 hrs, Volume= 0.206 af  
 Outflow = 2.32 cfs @ 12.04 hrs, Volume= 0.206 af, Atten= 49%, Lag= 4.9 min  
 Primary = 2.32 cfs @ 12.04 hrs, Volume= 0.206 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 719.99' @ 12.04 hrs Surf.Area= 3,518 sf Storage= 2,129 cf

Plug-Flow detention time= 27.0 min calculated for 0.206 af (100% of inflow)  
 Center-of-Mass det. time= 26.9 min ( 847.6 - 820.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	719.00'	3,161 cf	<b>39.50'W x 89.06'L x 3.50'H Field A</b> 12,312 cf Overall - 4,410 cf Embedded = 7,902 cf x 40.0% Voids
#2A	719.50'	4,410 cf	<b>ADS_StormTech SC-740 +Cap</b> x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 8 Rows of 12 Chambers
		7,571 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	720.88'	<b>10.5" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=2.32 cfs @ 12.04 hrs HW=719.99' (Free Discharge)  
 ↑ **1=Orifice/Grate** (Orifice Controls 2.32 cfs @ 3.51 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=719.00' (Free Discharge)  
 ↑ **2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 2P: UG Detention - Chamber Wizard Field A

**Chamber Model = ADS\_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length

8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

96 Chambers x 45.9 cf = 4,410.2 cf Chamber Storage

12,312.1 cf Field - 4,410.2 cf Chambers = 7,901.8 cf Stone x 40.0% Voids = 3,160.7 cf Stone Storage

Chamber Storage + Stone Storage = 7,571.0 cf = 0.174 af

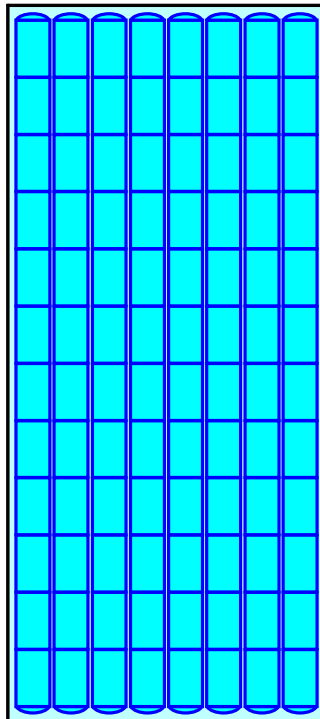
Overall Storage Efficiency = 61.5%

Overall System Size = 89.06' x 39.50' x 3.50'

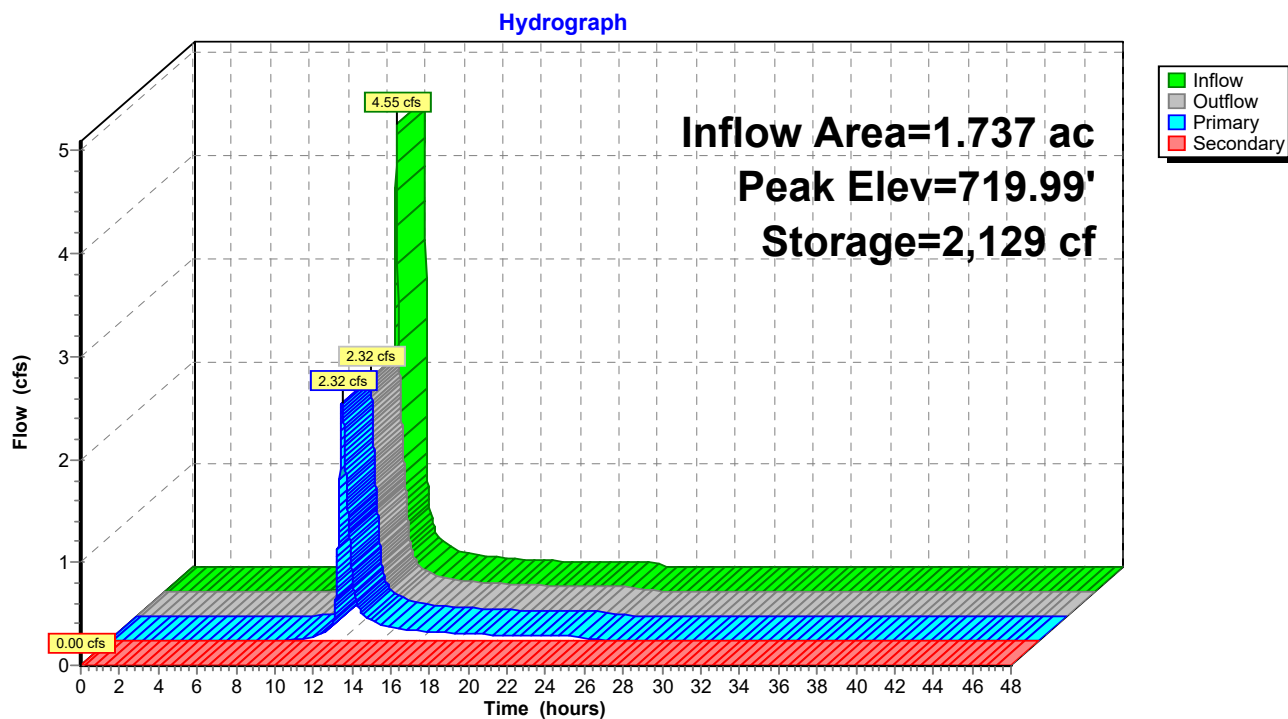
96 Chambers

456.0 cy Field

292.7 cy Stone



### Pond 2P: UG Detention





### Summary for Subcatchment 1: Proposed

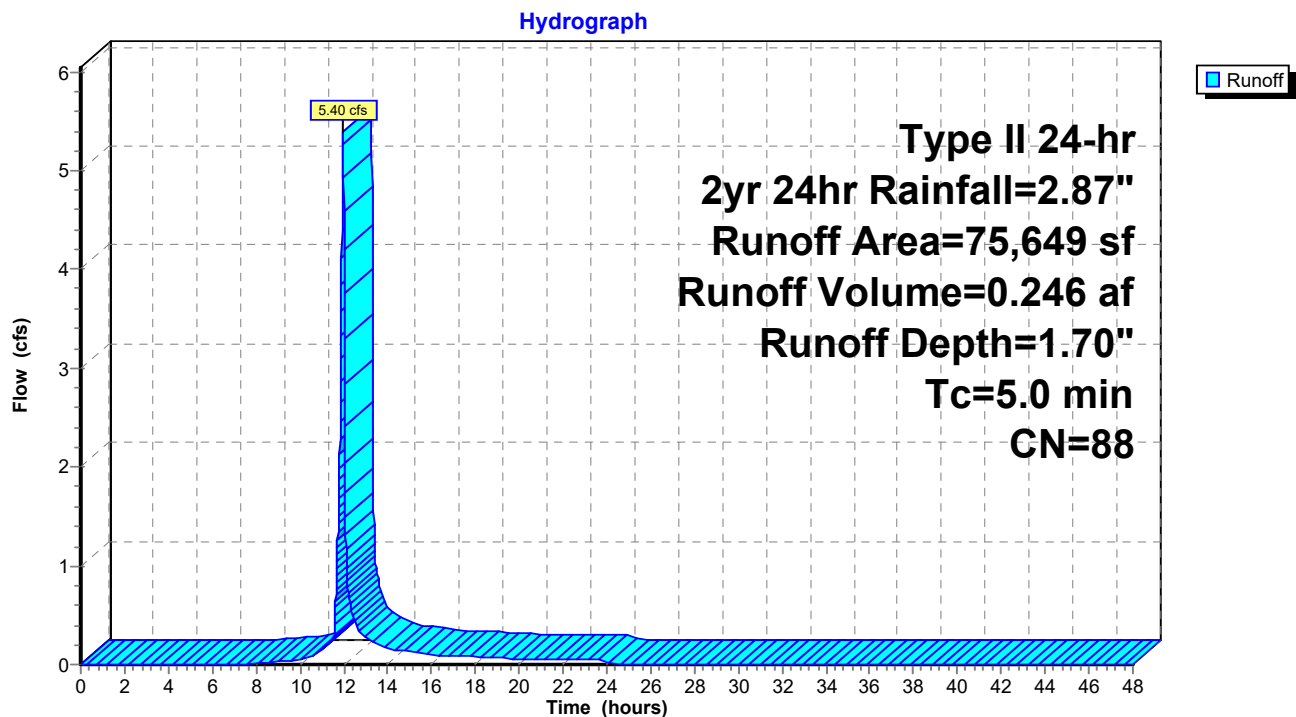
Runoff = 5.40 cfs @ 11.96 hrs, Volume= 0.246 af, Depth= 1.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 2yr 24hr Rainfall=2.87"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed



### Summary for Pond 2P: UG Detention

Inflow Area = 1.737 ac, 43.49% Impervious, Inflow Depth = 1.70" for 2yr 24hr event  
 Inflow = 5.40 cfs @ 11.96 hrs, Volume= 0.246 af  
 Outflow = 2.64 cfs @ 12.04 hrs, Volume= 0.246 af, Atten= 51%, Lag= 5.0 min  
 Primary = 2.64 cfs @ 12.04 hrs, Volume= 0.246 af  
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 720.15' @ 12.04 hrs Surf.Area= 3,518 sf Storage= 2,581 cf

Plug-Flow detention time= 25.9 min calculated for 0.246 af (100% of inflow)  
 Center-of-Mass det. time= 25.6 min ( 841.2 - 815.6 )

Volume	Invert	Avail.Storage	Storage Description
#1A	719.00'	3,161 cf	<b>39.50'W x 89.06'L x 3.50'H Field A</b> 12,312 cf Overall - 4,410 cf Embedded = 7,902 cf x 40.0% Voids
#2A	719.50'	4,410 cf	<b>ADS_StormTech SC-740 +Cap</b> x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 8 Rows of 12 Chambers
		7,571 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	720.88'	<b>10.5" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=2.64 cfs @ 12.04 hrs HW=720.15' (Free Discharge)  
 ↑ **1=Orifice/Grate** (Orifice Controls 2.64 cfs @ 4.00 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=719.00' (Free Discharge)  
 ↑ **2=Orifice/Grate** ( Controls 0.00 cfs)

## Pond 2P: UG Detention - Chamber Wizard Field A

**Chamber Model = ADS\_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length

8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

96 Chambers x 45.9 cf = 4,410.2 cf Chamber Storage

12,312.1 cf Field - 4,410.2 cf Chambers = 7,901.8 cf Stone x 40.0% Voids = 3,160.7 cf Stone Storage

Chamber Storage + Stone Storage = 7,571.0 cf = 0.174 af

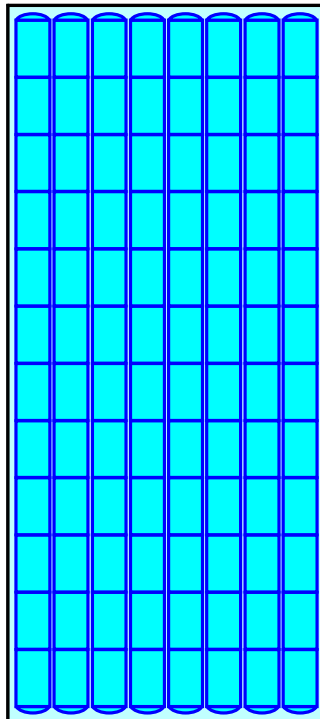
Overall Storage Efficiency = 61.5%

Overall System Size = 89.06' x 39.50' x 3.50'

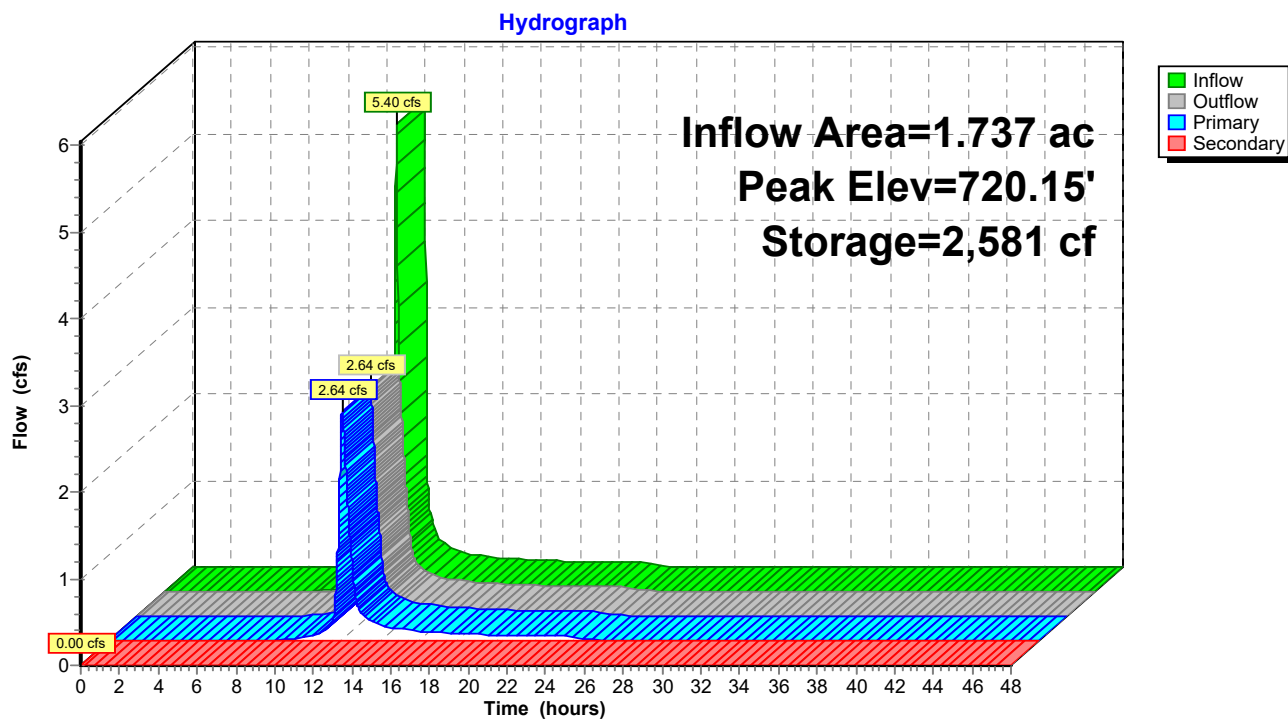
96 Chambers

456.0 cy Field

292.7 cy Stone



### Pond 2P: UG Detention



### Summary for Subcatchment 1: Proposed

Runoff = 7.55 cfs @ 11.96 hrs, Volume= 0.351 af, Depth= 2.42"

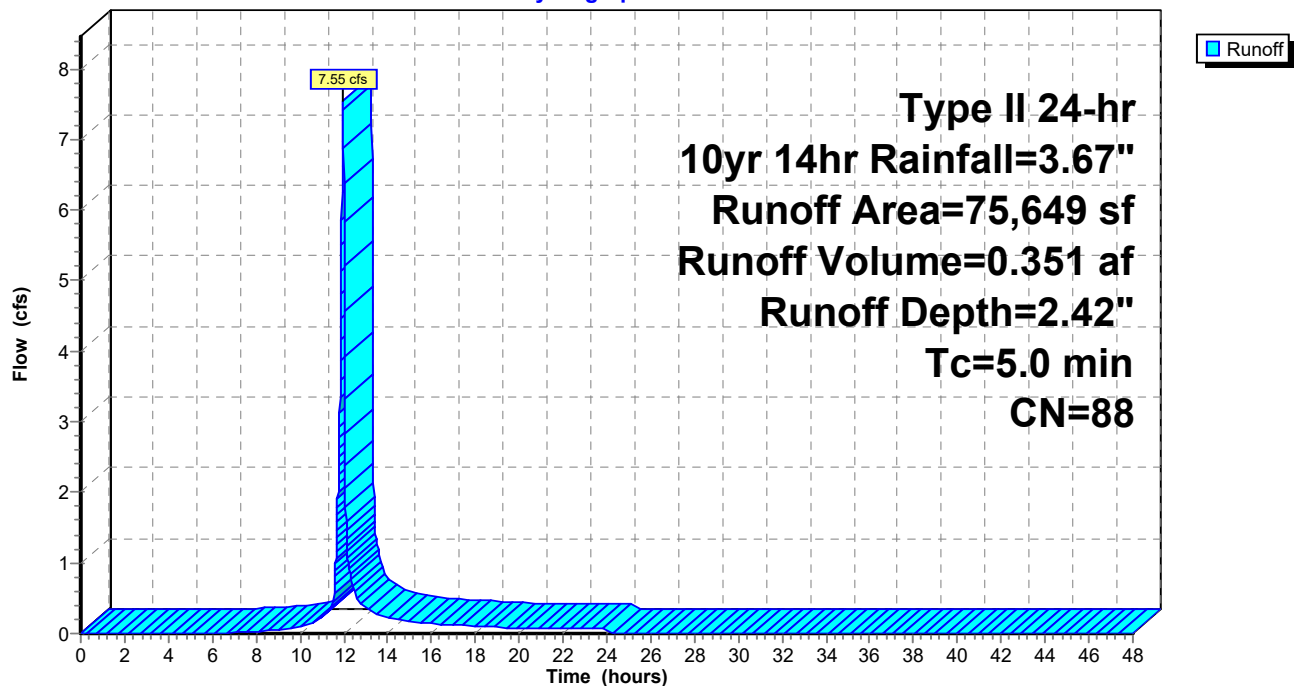
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10yr 14hr Rainfall=3.67"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed

Hydrograph



**Summary for Pond 2P: UG Detention**

Inflow Area = 1.737 ac, 43.49% Impervious, Inflow Depth = 2.42" for 10yr 14hr event  
Inflow = 7.55 cfs @ 11.96 hrs, Volume= 0.351 af  
Outflow = 3.39 cfs @ 12.05 hrs, Volume= 0.351 af, Atten= 55%, Lag= 5.4 min  
Primary = 3.39 cfs @ 12.05 hrs, Volume= 0.351 af  
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 720.60' @ 12.05 hrs Surf.Area= 3,518 sf Storage= 3,804 cf

Plug-Flow detention time= 23.9 min calculated for 0.351 af (100% of inflow)

Center-of-Mass det. time= 23.7 min ( 829.3 - 805.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	719.00'	3,161 cf	<b>39.50'W x 89.06'L x 3.50'H Field A</b> 12,312 cf Overall - 4,410 cf Embedded = 7,902 cf x 40.0% Voids
#2A	719.50'	4,410 cf	<b>ADS_StormTech SC-740 +Cap</b> x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 8 Rows of 12 Chambers
		7,571 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	720.88'	<b>10.5" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=3.39 cfs @ 12.05 hrs HW=720.60' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 3.39 cfs @ 5.14 fps)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=719.00' (Free Discharge)

↑**2=Orifice/Grate** ( Controls 0.00 cfs)

## **Pond 2P: UG Detention - Chamber Wizard Field A**

**Chamber Model = ADS\_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length

8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

96 Chambers x 45.9 cf = 4,410.2 cf Chamber Storage

12,312.1 cf Field - 4,410.2 cf Chambers = 7,901.8 cf Stone x 40.0% Voids = 3,160.7 cf Stone Storage

Chamber Storage + Stone Storage = 7,571.0 cf = 0.174 af

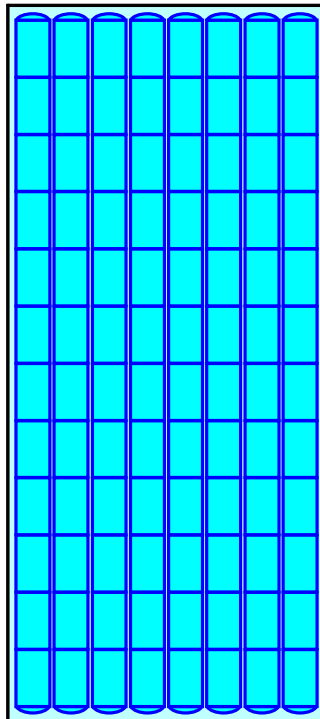
Overall Storage Efficiency = 61.5%

Overall System Size = 89.06' x 39.50' x 3.50'

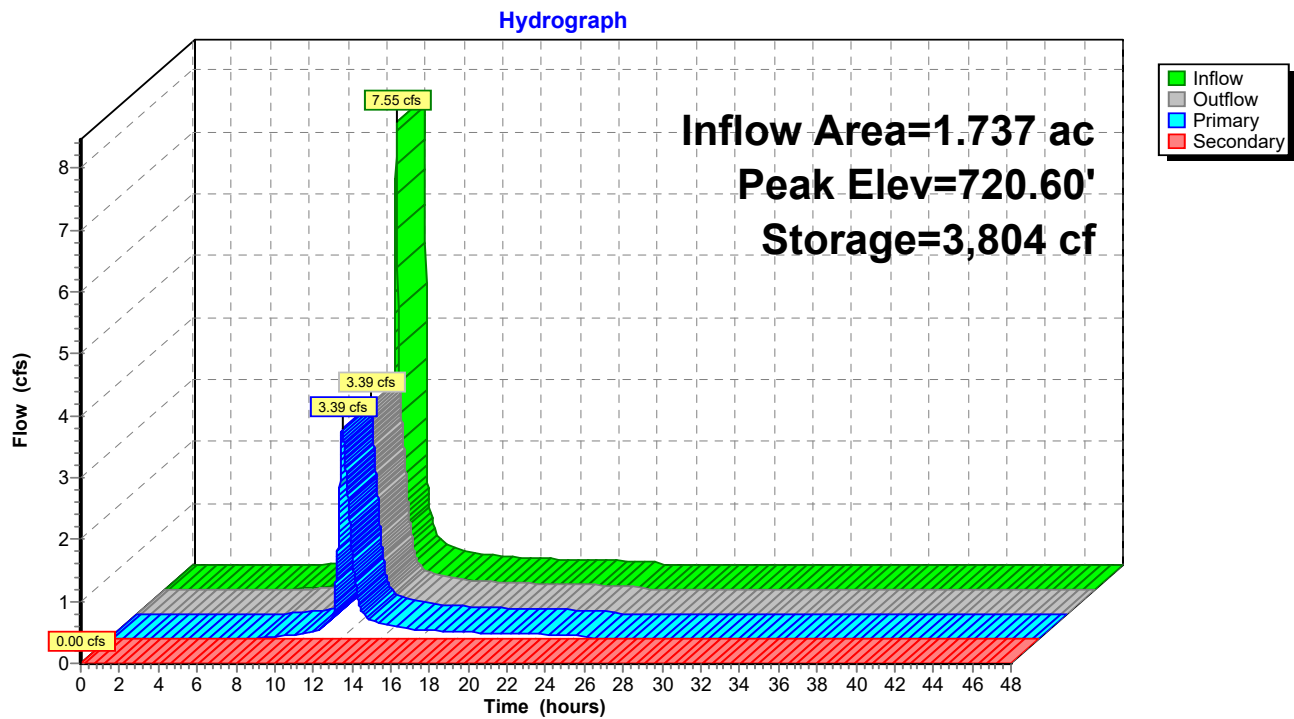
96 Chambers

456.0 cy Field

292.7 cy Stone



### Pond 2P: UG Detention





### Summary for Subcatchment 1: Proposed

Runoff = 8.80 cfs @ 11.96 hrs, Volume= 0.412 af, Depth= 2.85"

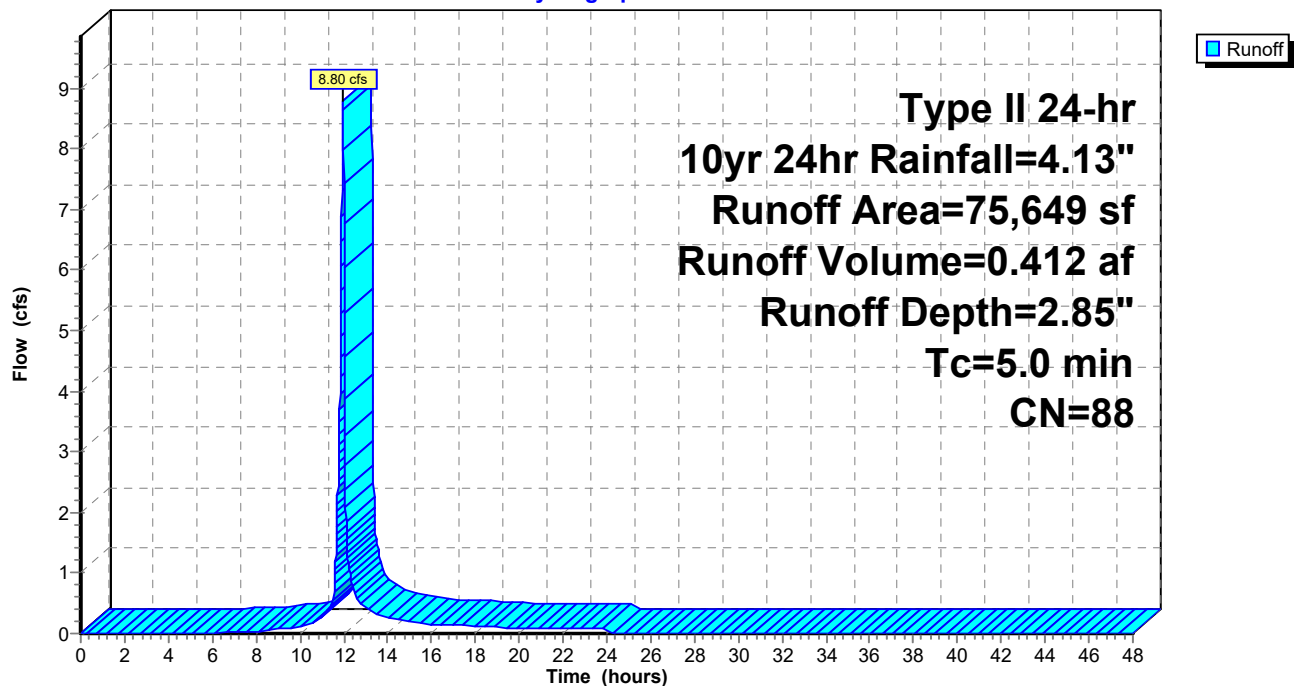
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 10yr 24hr Rainfall=4.13"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed

Hydrograph



**Summary for Pond 2P: UG Detention**

Inflow Area = 1.737 ac, 43.49% Impervious, Inflow Depth = 2.85" for 10yr 24hr event  
 Inflow = 8.80 cfs @ 11.96 hrs, Volume= 0.412 af  
 Outflow = 3.79 cfs @ 12.05 hrs, Volume= 0.412 af, Atten= 57%, Lag= 5.6 min  
 Primary = 3.79 cfs @ 12.05 hrs, Volume= 0.412 af  
 Secondary = 0.00 cfs @ 12.05 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3

Peak Elev= 720.88' @ 12.05 hrs Surf.Area= 3,518 sf Storage= 4,551 cf

Plug-Flow detention time= 23.1 min calculated for 0.412 af (100% of inflow)

Center-of-Mass det. time= 23.1 min ( 824.1 - 800.9 )

Volume	Invert	Avail.Storage	Storage Description
#1A	719.00'	3,161 cf	<b>39.50'W x 89.06'L x 3.50'H Field A</b> 12,312 cf Overall - 4,410 cf Embedded = 7,902 cf x 40.0% Voids
#2A	719.50'	4,410 cf	<b>ADS_StormTech SC-740 +Cap</b> x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 8 Rows of 12 Chambers
		7,571 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	720.88'	<b>10.5" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=3.79 cfs @ 12.05 hrs HW=720.88' (Free Discharge)

↑ **1=Orifice/Grate** (Orifice Controls 3.79 cfs @ 5.75 fps)

**Secondary OutFlow** Max=0.00 cfs @ 12.05 hrs HW=720.88' (Free Discharge)

↑ **2=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.20 fps)

## Pond 2P: UG Detention - Chamber Wizard Field A

**Chamber Model = ADS\_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length

8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

96 Chambers x 45.9 cf = 4,410.2 cf Chamber Storage

12,312.1 cf Field - 4,410.2 cf Chambers = 7,901.8 cf Stone x 40.0% Voids = 3,160.7 cf Stone Storage

Chamber Storage + Stone Storage = 7,571.0 cf = 0.174 af

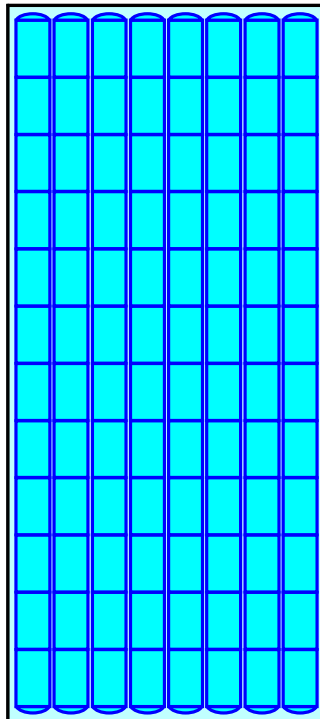
Overall Storage Efficiency = 61.5%

Overall System Size = 89.06' x 39.50' x 3.50'

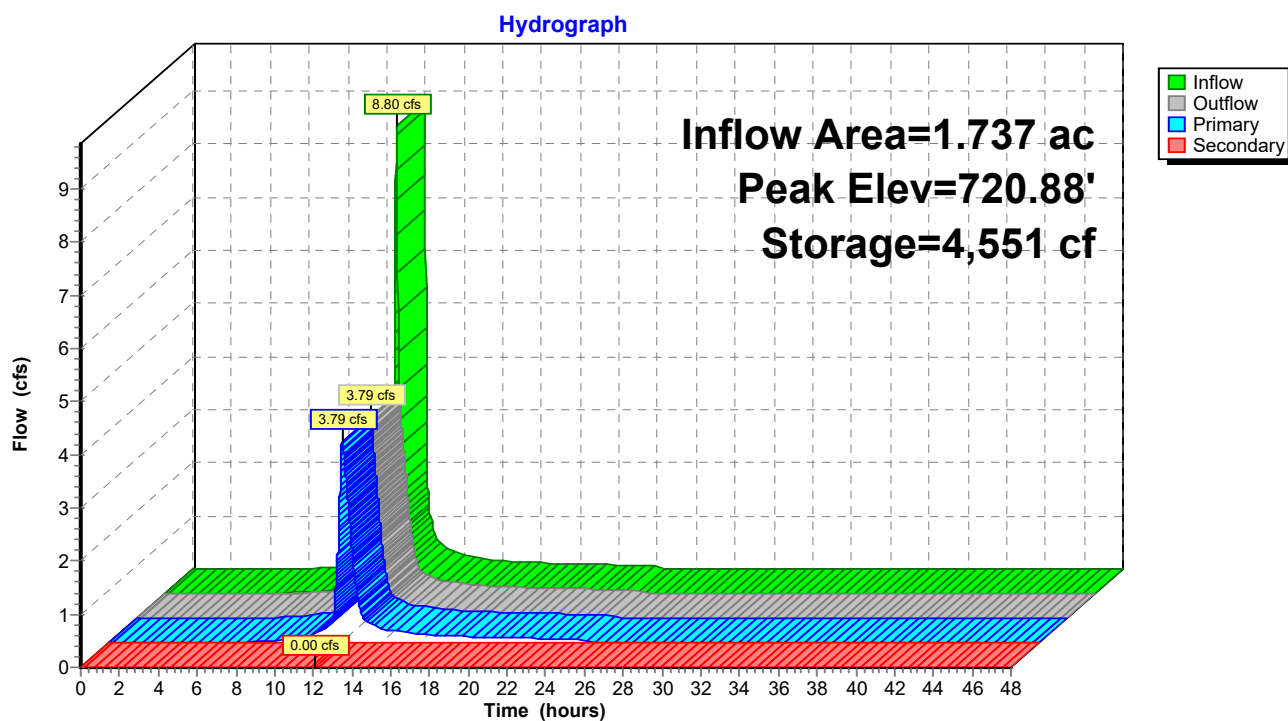
96 Chambers

456.0 cy Field

292.7 cy Stone



### Pond 2P: UG Detention



### Summary for Subcatchment 1: Proposed

Runoff = 11.21 cfs @ 11.96 hrs, Volume= 0.534 af, Depth= 3.69"

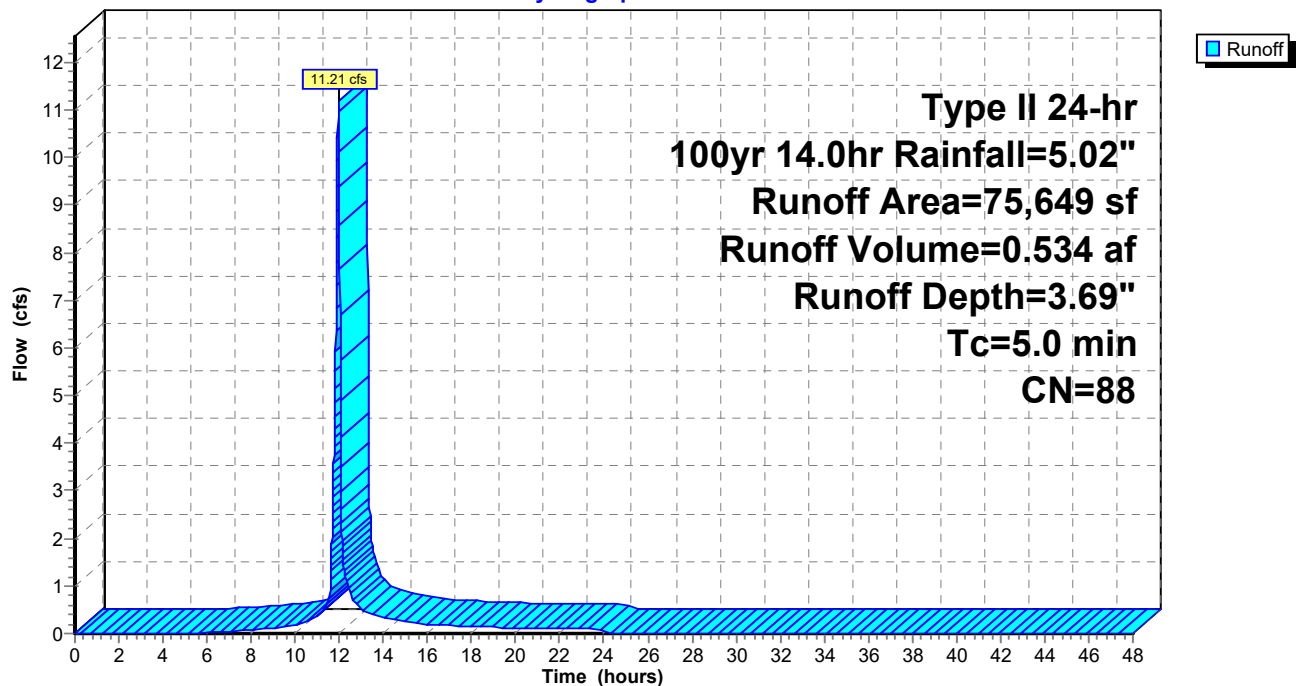
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 100yr 14.0hr Rainfall=5.02"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed

Hydrograph



### Summary for Pond 2P: UG Detention

Inflow Area = 1.737 ac, 43.49% Impervious, Inflow Depth = 3.69" for 100yr 14.0hr event  
 Inflow = 11.21 cfs @ 11.96 hrs, Volume= 0.534 af  
 Outflow = 5.51 cfs @ 12.04 hrs, Volume= 0.534 af, Atten= 51%, Lag= 5.1 min  
 Primary = 4.47 cfs @ 12.04 hrs, Volume= 0.524 af  
 Secondary = 1.03 cfs @ 12.04 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 721.44' @ 12.04 hrs Surf.Area= 3,518 sf Storage= 5,869 cf

Plug-Flow detention time= 21.9 min calculated for 0.533 af (100% of inflow)  
 Center-of-Mass det. time= 22.0 min ( 815.6 - 793.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	719.00'	3,161 cf	<b>39.50'W x 89.06'L x 3.50'H Field A</b> 12,312 cf Overall - 4,410 cf Embedded = 7,902 cf x 40.0% Voids
#2A	719.50'	4,410 cf	<b>ADS_StormTech SC-740 +Cap</b> x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 8 Rows of 12 Chambers
		7,571 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	720.88'	<b>10.5" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=4.47 cfs @ 12.04 hrs HW=721.44' (Free Discharge)  
 ↑**1=Orifice/Grate** (Orifice Controls 4.47 cfs @ 6.77 fps)

**Secondary OutFlow** Max=1.03 cfs @ 12.04 hrs HW=721.44' (Free Discharge)  
 ↑**2=Orifice/Grate** (Orifice Controls 1.03 cfs @ 2.54 fps)

## Pond 2P: UG Detention - Chamber Wizard Field A

**Chamber Model = ADS\_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length

8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

96 Chambers x 45.9 cf = 4,410.2 cf Chamber Storage

12,312.1 cf Field - 4,410.2 cf Chambers = 7,901.8 cf Stone x 40.0% Voids = 3,160.7 cf Stone Storage

Chamber Storage + Stone Storage = 7,571.0 cf = 0.174 af

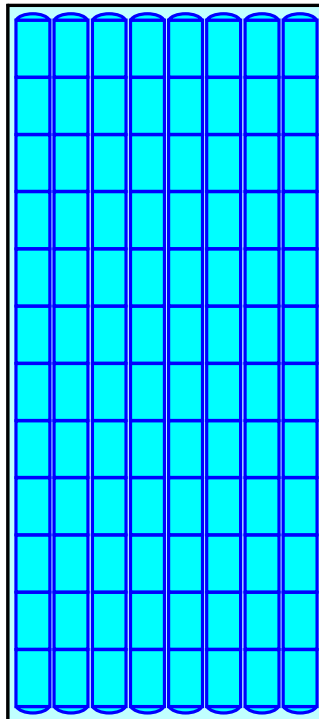
Overall Storage Efficiency = 61.5%

Overall System Size = 89.06' x 39.50' x 3.50'

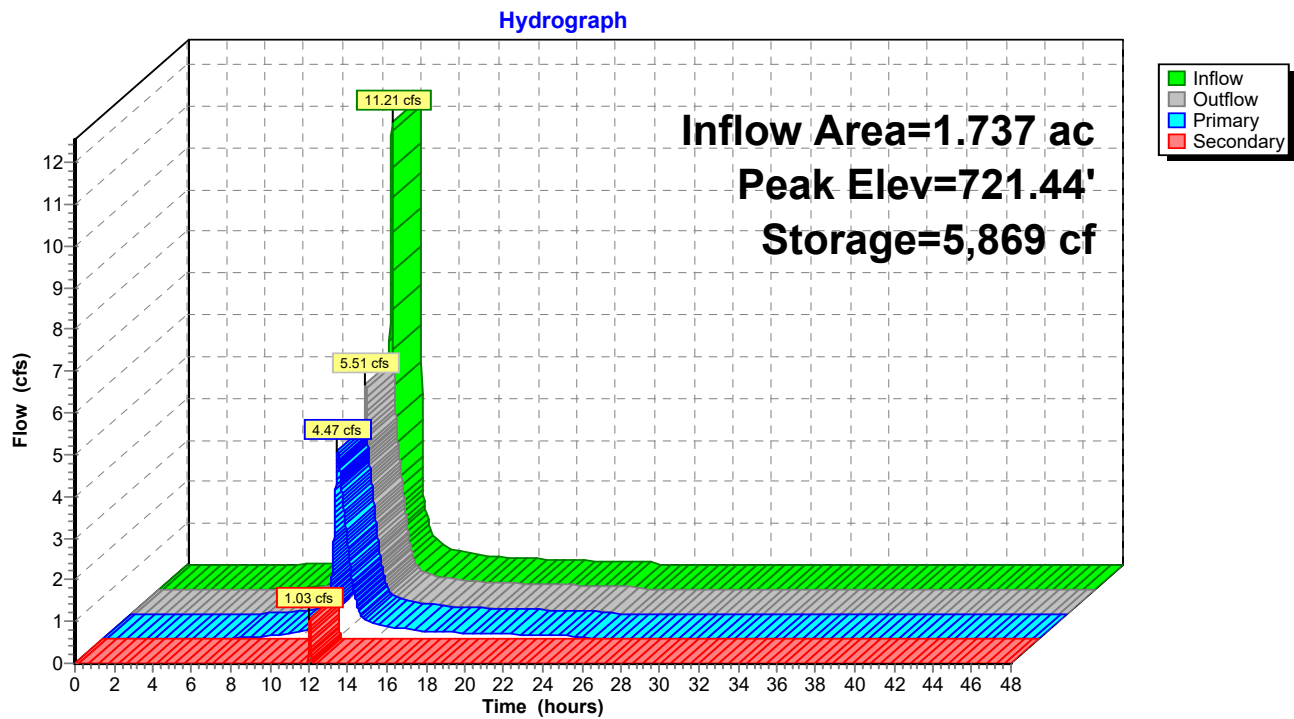
96 Chambers

456.0 cy Field

292.7 cy Stone



### Pond 2P: UG Detention





### Summary for Subcatchment 1: Proposed

Runoff = 12.88 cfs @ 11.96 hrs, Volume= 0.619 af, Depth= 4.28"

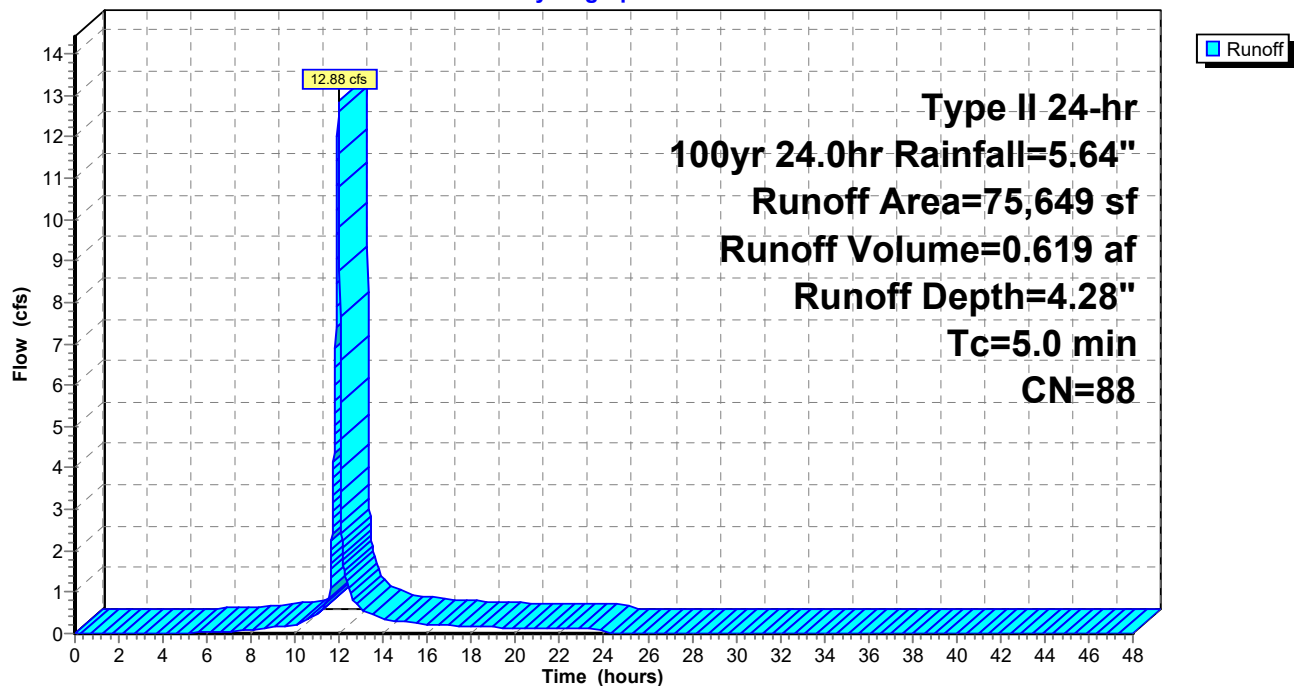
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
 Type II 24-hr 100yr 24.0hr Rainfall=5.64"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed

Hydrograph



### Summary for Pond 2P: UG Detention

Inflow Area = 1.737 ac, 43.49% Impervious, Inflow Depth = 4.28" for 100yr 24.0hr event  
 Inflow = 12.88 cfs @ 11.96 hrs, Volume= 0.619 af  
 Outflow = 7.01 cfs @ 12.04 hrs, Volume= 0.619 af, Atten= 46%, Lag= 4.7 min  
 Primary = 4.91 cfs @ 12.04 hrs, Volume= 0.594 af  
 Secondary = 2.10 cfs @ 12.04 hrs, Volume= 0.026 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3  
 Peak Elev= 721.84' @ 12.04 hrs Surf.Area= 3,518 sf Storage= 6,636 cf

Plug-Flow detention time= 21.0 min calculated for 0.619 af (100% of inflow)  
 Center-of-Mass det. time= 21.1 min ( 810.6 - 789.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	719.00'	3,161 cf	<b>39.50'W x 89.06'L x 3.50'H Field A</b> 12,312 cf Overall - 4,410 cf Embedded = 7,902 cf x 40.0% Voids
#2A	719.50'	4,410 cf	<b>ADS_StormTech SC-740 +Cap</b> x 96 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 8 Rows of 12 Chambers
		7,571 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	719.00'	<b>11.0" Vert. Orifice/Grate</b> C= 0.600
#2	Secondary	720.88'	<b>10.5" Vert. Orifice/Grate</b> C= 0.600

**Primary OutFlow** Max=4.90 cfs @ 12.04 hrs HW=721.84' (Free Discharge)  
 ↑**1=Orifice/Grate** (Orifice Controls 4.90 cfs @ 7.43 fps)

**Secondary OutFlow** Max=2.09 cfs @ 12.04 hrs HW=721.84' (Free Discharge)  
 ↑**2=Orifice/Grate** (Orifice Controls 2.09 cfs @ 3.48 fps)

## Pond 2P: UG Detention - Chamber Wizard Field A

**Chamber Model = ADS\_StormTechSC-740 +Cap (ADS StormTech®SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

12 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 87.06' Row Length +12.0" End Stone x 2 = 89.06' Base Length

8 Rows x 51.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 39.50' Base Width

6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

96 Chambers x 45.9 cf = 4,410.2 cf Chamber Storage

12,312.1 cf Field - 4,410.2 cf Chambers = 7,901.8 cf Stone x 40.0% Voids = 3,160.7 cf Stone Storage

Chamber Storage + Stone Storage = 7,571.0 cf = 0.174 af

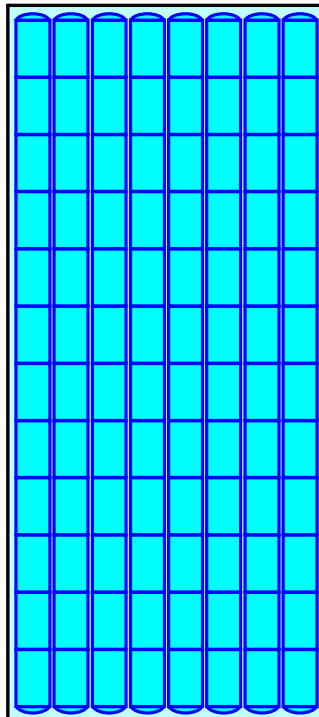
Overall Storage Efficiency = 61.5%

Overall System Size = 89.06' x 39.50' x 3.50'

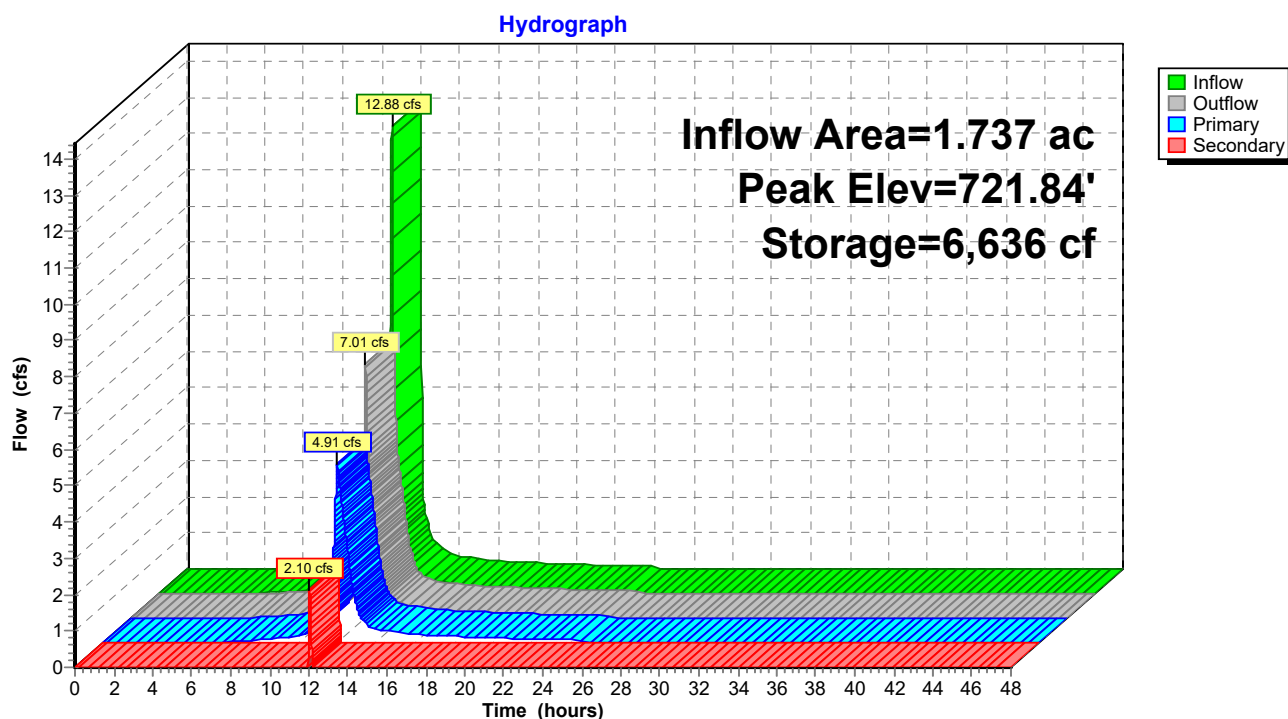
96 Chambers

456.0 cy Field

292.7 cy Stone



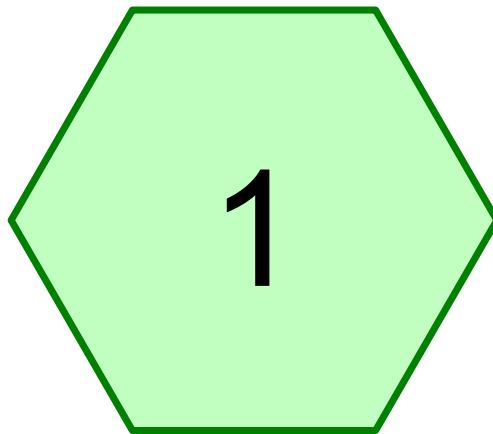
### Pond 2P: UG Detention



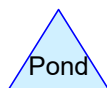
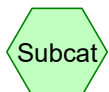
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**APPENDIX G**  
**WATER QUALITY CALCULATIONS**

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# Proposed



**Routing Diagram for 180-416 - Water Quality**

Prepared by CEC, Inc., Printed 5/29/2018

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## 180-416 - Water Quality

Prepared by CEC, Inc.

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Page 2

### Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.981	80	>75% Grass cover, Good, HSG D (1)
0.755	98	Paved parking, HSG B (1)
<b>1.737</b>	<b>88</b>	<b>TOTAL AREA</b>

**180-416 - Water Quality**

Prepared by CEC, Inc.

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Type II 24-hr 2yr 0.25hr Rainfall=0.77"

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Page 3

**Summary for Subcatchment 1: Proposed**

Runoff = 0.38 cfs @ 11.98 hrs, Volume= 0.019 af, Depth= 0.13"

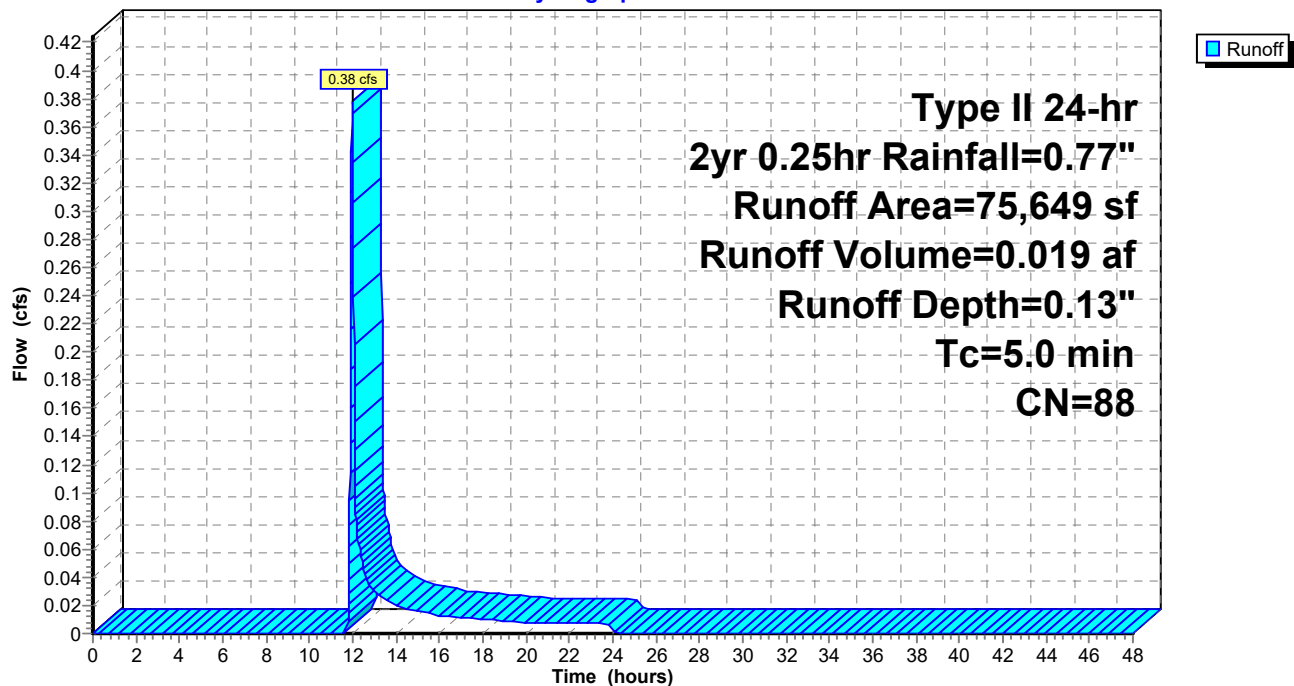
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 0.25hr Rainfall=0.77"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

**Subcatchment 1: Proposed**

Hydrograph





**180-416 - Water Quality**

Prepared by CEC, Inc.

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Type II 24-hr 2yr 0.5hr Rainfall=1.06"

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**Summary for Subcatchment 1: Proposed**

Runoff = 0.91 cfs @ 11.97 hrs, Volume= 0.042 af, Depth= 0.29"

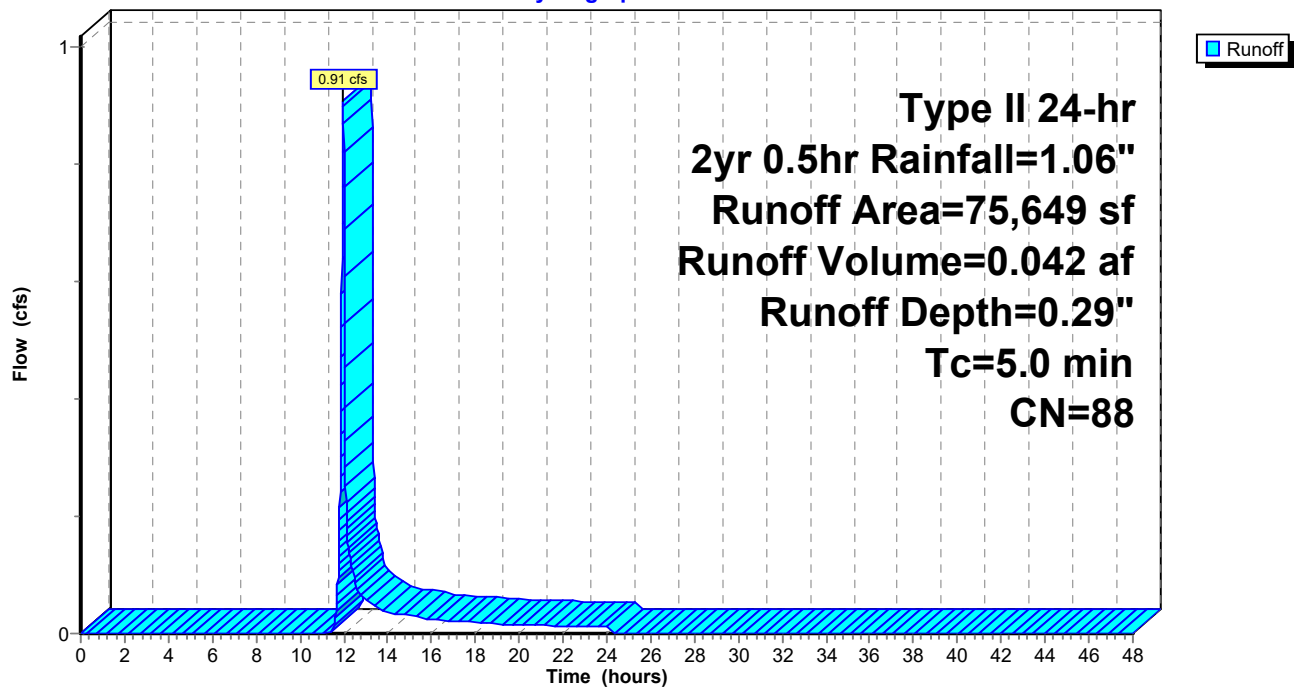
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 0.5hr Rainfall=1.06"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

**Subcatchment 1: Proposed**

Hydrograph



**180-416 - Water Quality**

Prepared by CEC, Inc.

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Type II 24-hr 2yr 01.0hr Rainfall=1.34"

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**Summary for Subcatchment 1: Proposed**

Runoff = 1.51 cfs @ 11.97 hrs, Volume= 0.068 af, Depth= 0.47"

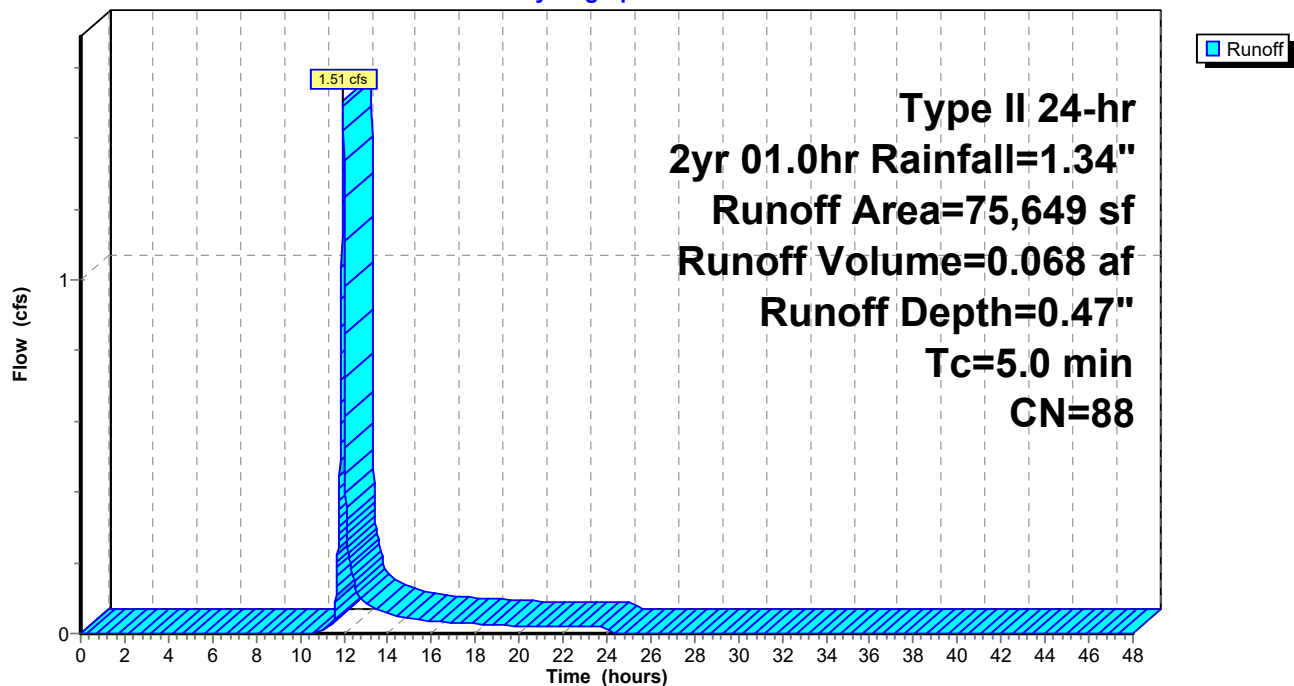
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 01.0hr Rainfall=1.34"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

**Subcatchment 1: Proposed**

Hydrograph



**180-416 - Water Quality**

Prepared by CEC, Inc.

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Type II 24-hr 2yr 02.0hr Rainfall=1.64"

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**Summary for Subcatchment 1: Proposed**

Runoff = 2.21 cfs @ 11.96 hrs, Volume= 0.099 af, Depth= 0.68"

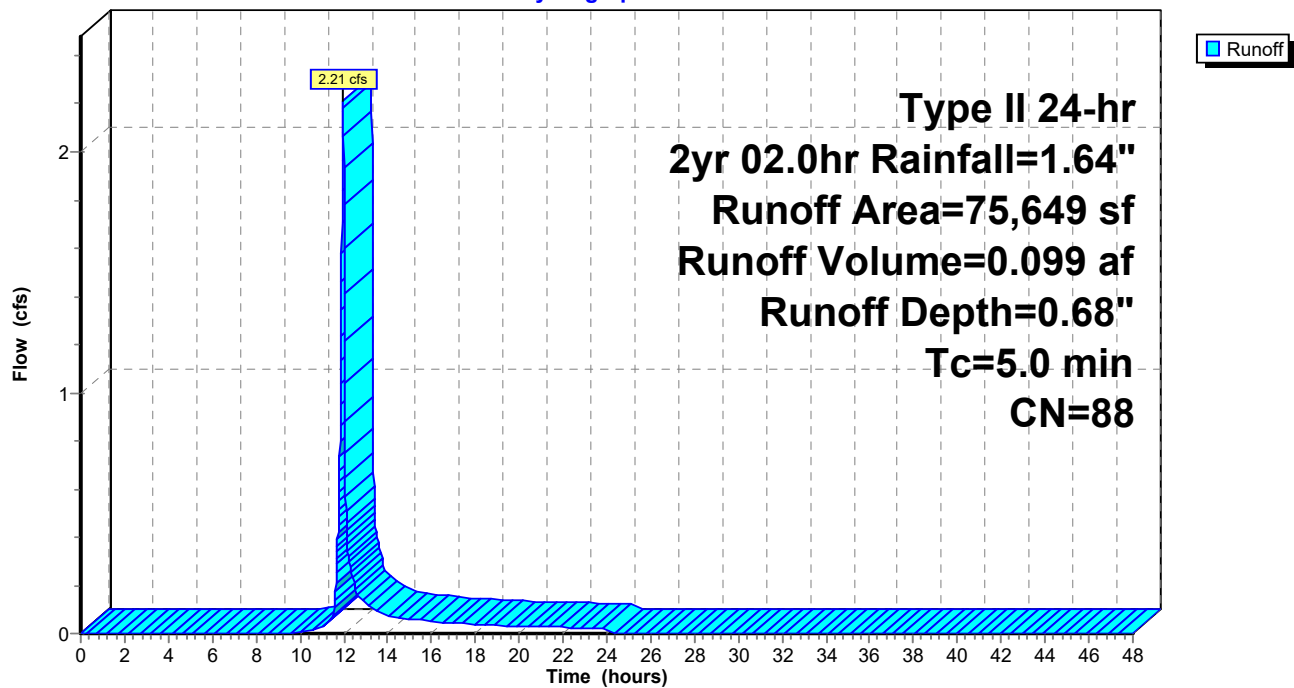
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 02.0hr Rainfall=1.64"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

**Subcatchment 1: Proposed**

Hydrograph



**180-416 - Water Quality**

Prepared by CEC, Inc.

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Type II 24-hr 2yr 03.0hr Rainfall=1.76"

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**Summary for Subcatchment 1: Proposed**

Runoff = 2.51 cfs @ 11.96 hrs, Volume= 0.112 af, Depth= 0.78"

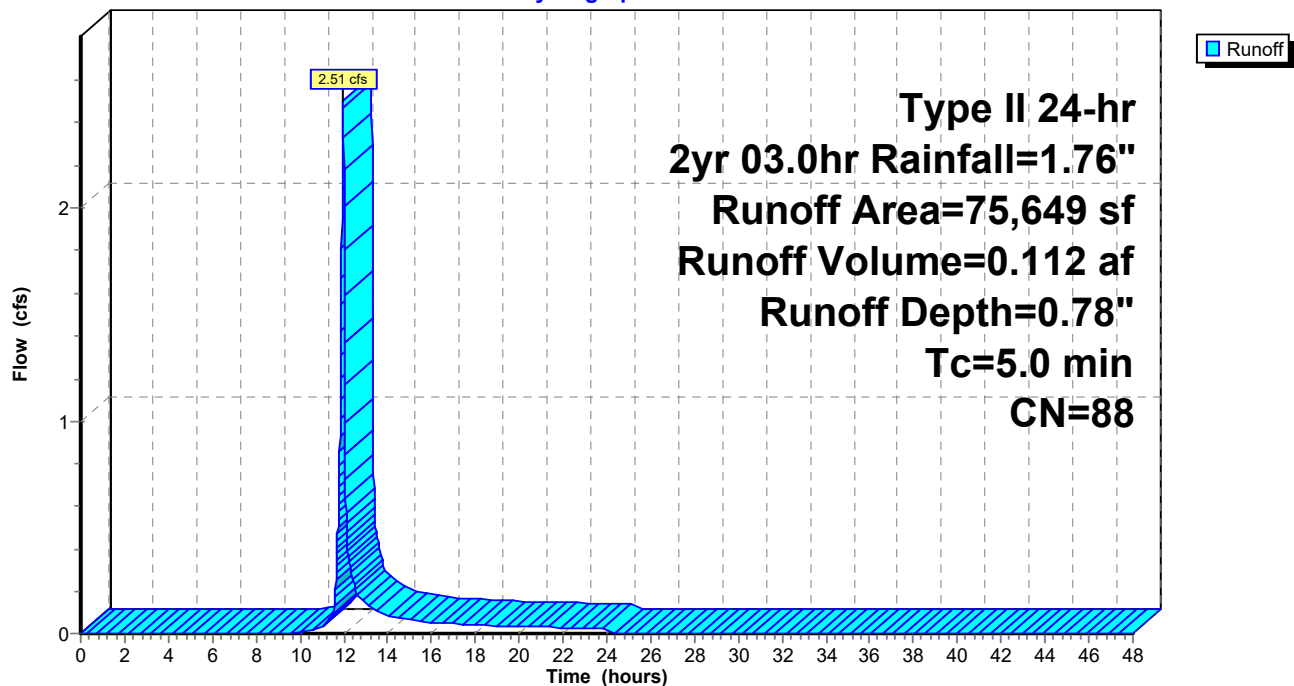
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 03.0hr Rainfall=1.76"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

**Subcatchment 1: Proposed**

Hydrograph



**180-416 - Water Quality**

Prepared by CEC, Inc.

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Type II 24-hr 2yr 06.0hr Rainfall=2.13"

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**Summary for Subcatchment 1: Proposed**

Runoff = 3.45 cfs @ 11.96 hrs, Volume= 0.155 af, Depth= 1.07"

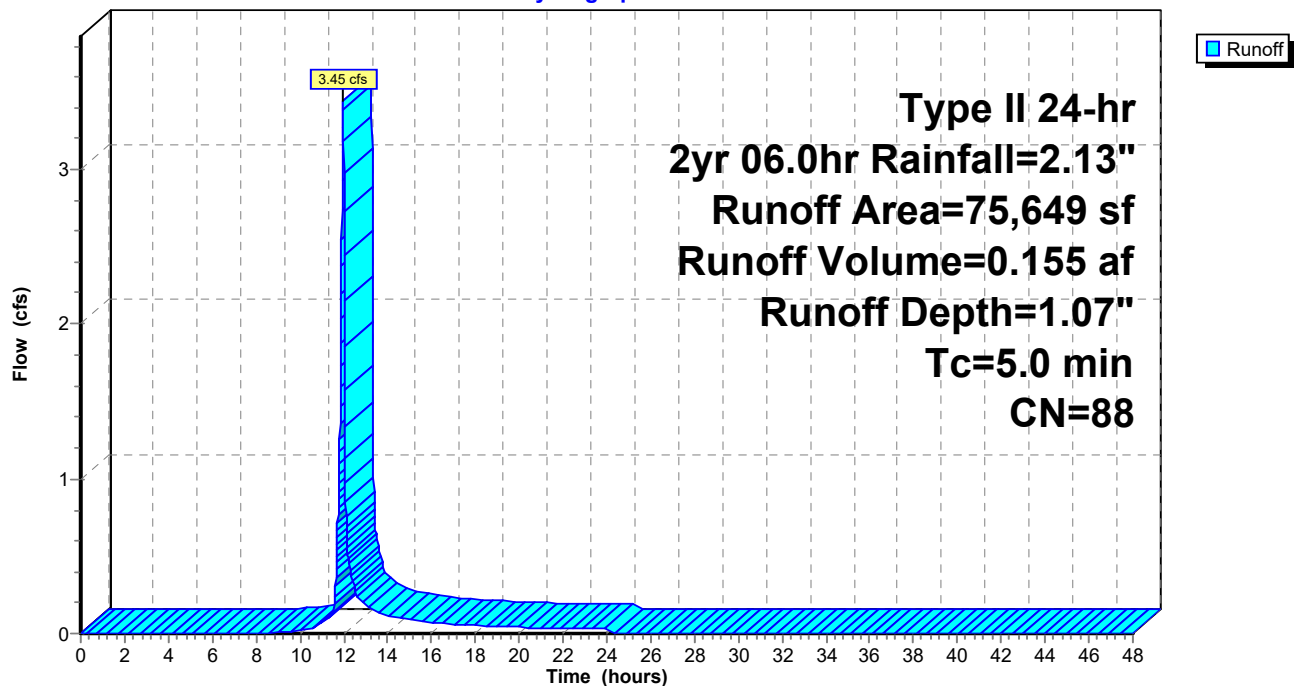
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 06.0hr Rainfall=2.13"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

**Subcatchment 1: Proposed**

Hydrograph



## 180-416 - Water Quality

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Type II 24-hr 2yr 14hr Rainfall=2.55"

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### Summary for Subcatchment 1: Proposed

Runoff = 4.55 cfs @ 11.96 hrs, Volume= 0.206 af, Depth= 1.42"

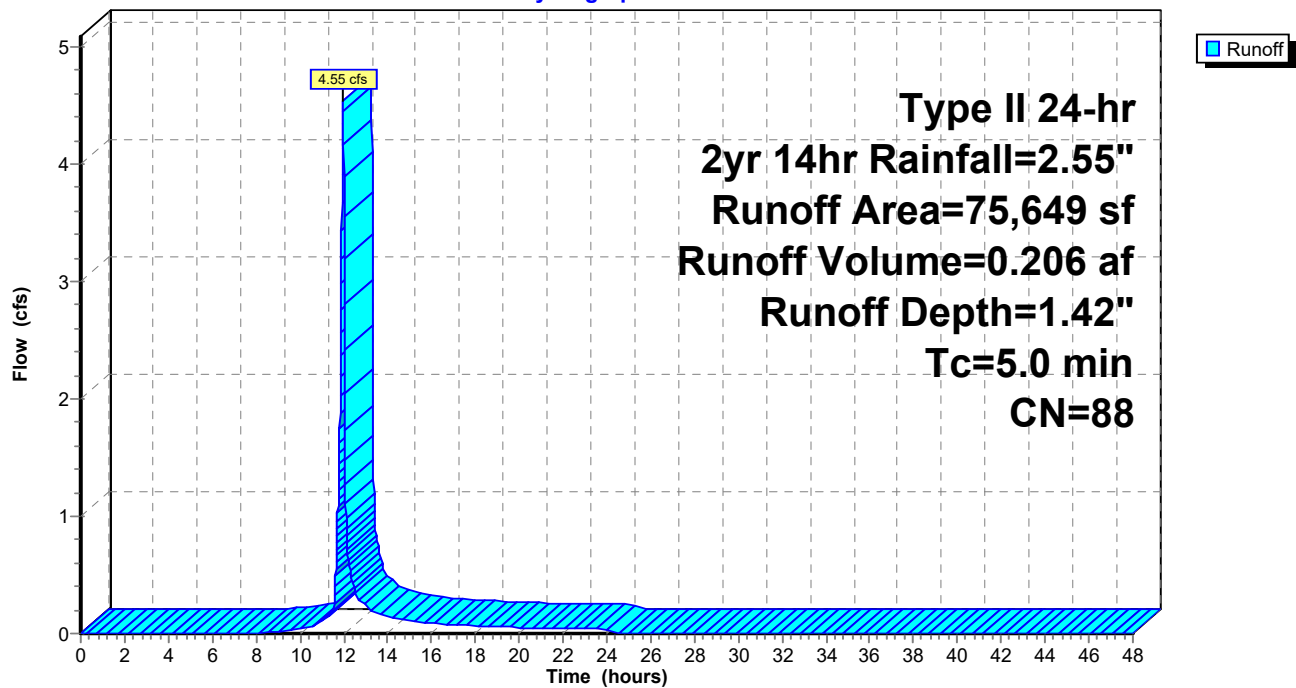
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 14hr Rainfall=2.55"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed

Hydrograph



## 180-416 - Water Quality

Prepared by CEC, Inc.

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Type II 24-hr 2yr 24hr Rainfall=2.87"

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### Summary for Subcatchment 1: Proposed

Runoff = 5.40 cfs @ 11.96 hrs, Volume= 0.246 af, Depth= 1.70"

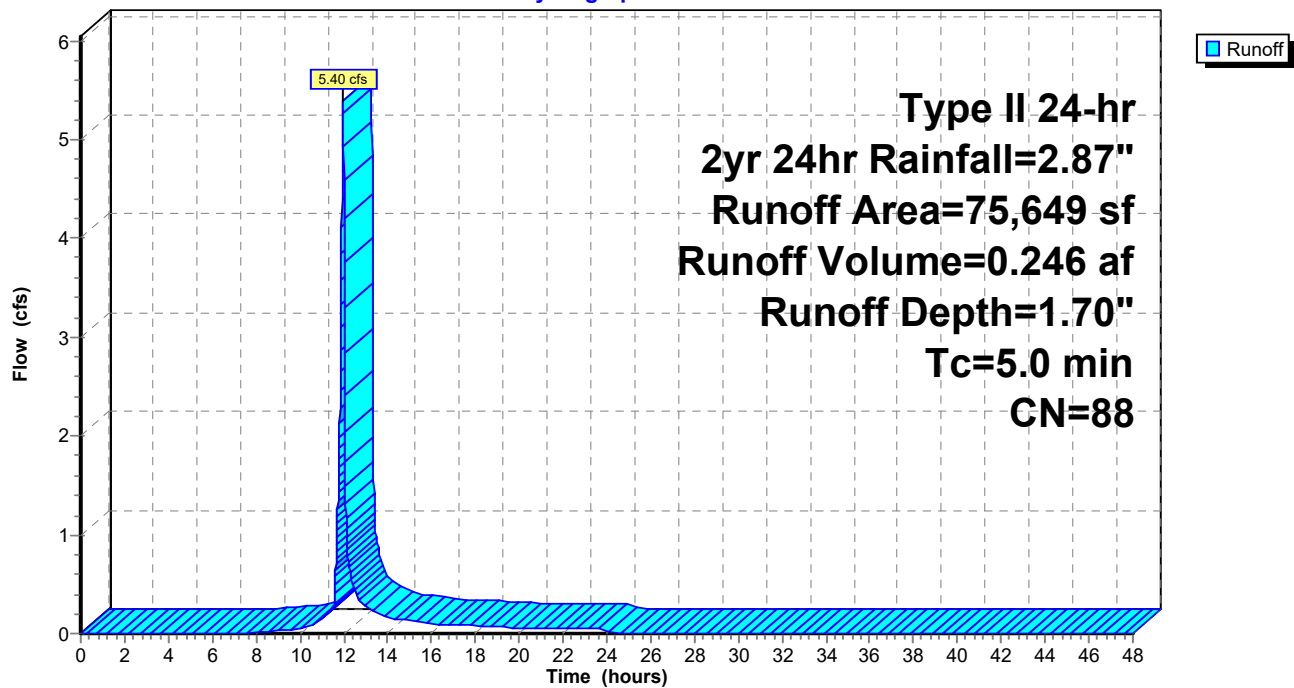
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs  
Type II 24-hr 2yr 24hr Rainfall=2.87"

Area (sf)	CN	Description
32,896	98	Paved parking, HSG B
42,753	80	>75% Grass cover, Good, HSG D
75,649	88	Weighted Average
42,753		56.51% Pervious Area
32,896		43.49% Impervious Area

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

### Subcatchment 1: Proposed

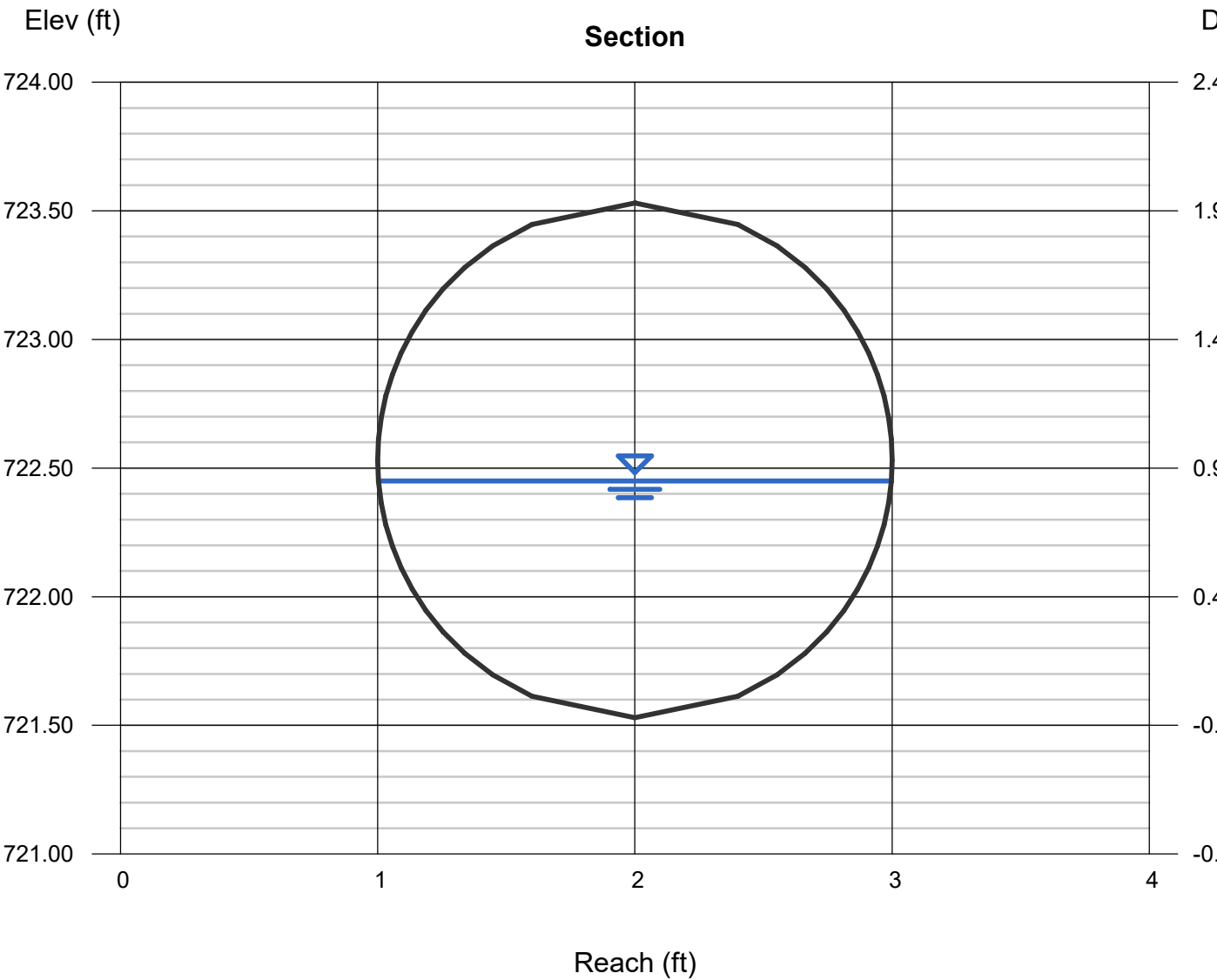
Hydrograph



# Channel Report

## WQ Weir Height

<b>Circular</b>		<b>Highlighted</b>	
Diameter (ft)	= 2.00	Depth (ft)	= 0.92
		Q (cfs)	= 5.407
		Area (sqft)	= 1.42
Invert Elev (ft)	= 721.53	Velocity (ft/s)	= 3.81
Slope (%)	= 0.30	Wetted Perim (ft)	= 2.99
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.83
		Top Width (ft)	= 1.99
		EGL (ft)	= 1.15
<b>Calculations</b>			
Compute by:	Q vs Depth		
No. Increments	= 50		







# Aqua-Swirl™ Sizing Chart *(English)*

Aqua-Swirl™ Model	Swirl Chamber Diameter (ft.)	Maximum Stub-Out Pipe Outer Diameter (in.)		Water Quality Treatment Flow <sup>2</sup> (cfs)	Oil/Debris Storage Capacity (gal)	Sediment Storage Capacity (ft <sup>3</sup> )
		On/Offline	CFD <sup>1</sup>			
AS-2	2.50	8	12	1.1	37	10
AS-3	3.25	10	16	1.8	110	20
AS-4	4.25	12	18	3.2	190	32
AS-5	5.00	12	24	4.4	270	45
AS-6	6.00	14	30	6.3	390	65
AS-7	7.00	16	36	8.6	540	90
AS-8	8.00	18	42	11.2	710	115
AS-9	9.00	20	48	14.2	910	145
AS-10	10.0	22	54	17.5	1130	180
AS-12	12.0	24	48	25.2	1698	270
AS-XX	Custom	--	--	>26	--	--

\*Higher water quality treatment flow rates can be designed with multiple swirls.

- 1) The **Aqua-Swirl™ Conveyance Flow Diversion (CFD)** provides full treatment of the "first flush," while the peak design storm is diverted and channeled through the main conveyance pipe. Please refer to your local representative for more information.
- 2) Many regulatory agencies are establishing "water quality treatment flow rates" for their areas based on the initial movement of pollutants into the storm drainage system. The treatment flow rate of the Aqua-Swirl™ system is engineered to meet or exceed the local water quality treatment criteria. This "**water quality treatment flow rate**" typically represents approximately 90% to 95% of the total annual runoff volume.

The design and orientation of the Aqua-Filter™ generally entails some degree of customization. For assistance in design and specific sizing using historical rainfall data, please refer to an AquaShield™ representative or visit our website at [www.AquaShieldInc.com](http://www.AquaShieldInc.com). CAD details and specifications are available upon request.

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**APPENDIX H**  
**PREVIOUS DRAINAGE REPORT (PARTIAL)**

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