

STORM DRAINAGE REPORT

BROOKMAN PLACE SUBDIVISION

WASHINGTON COUNTY ASSESSOR'S MAP NO. **3S-1-06B**, LOT **101**
SHERWOOD, OREGON

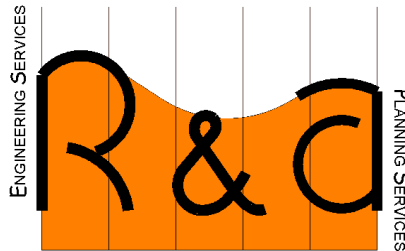
PREPARED FOR:
WALKER JOHN, OWNER
OLIVIA BEACH SALES & CONSTRUCTION
3329 SW HWY 101
LINCOLN CITY, OR 97367

PREPARED BY:
REECE & ASSOCIATES, INC.
321 1ST AVE. EAST, SUITE 3A
ALBANY, OR 97321
541-926-2428



RENEWS 12/31/22

DAVID J REECE, PE
JULY 28, 2022



Reece & associates, inc.

TABLE OF CONTENTS

1. [PROJECT DESCRIPTION](#)
2. [REGULATORY DESIGN STANDARDS](#)
3. [METHODOLOGY](#)
4. [PRECIPITATION](#)
5. [PRE-DEVELOPMENT CONDITIONS](#)
6. [POST-DEVELOPMENT CONDITIONS](#)
7. [WATER QUALITY](#)
8. [CONCLUSION](#)

Plans to Accompany Report

D1 – Pre-Development Drainage Plan
D2 – Post-Development Drainage Plan

Exhibit A – USGS Soils Map and Soils Information
Exhibit B – Bio-Filtration Swale

HydroCAD® Report

1- Project Description:

This storm drainage report has been developed for the proposed Brookman Place Subdivision in Sherwood, Oregon. The 2-acre site, located in SW Sherwood off SW Brookman Road, is proposed for development into a 10-lot subdivision for single-family residences. Access to the site will be via the westward extension of SW Wapato Island Drive.

Post-developed runoff rates will be attenuated to the pre-developed runoff rates using an above ground detention facility with an outflow control structure, and water quality will be managed via a vegetated swale built into the bottom of the detention facility.

2- Regulatory Design Standards:

The City of Sherwood defers to the Clean Water Services (CWS) Standards for Runoff Treatment and Control. Standards referenced for this Storm Drainage Report include Chapter 4 of the CWS Construction Specifications, R&O 19-5 Amended by R&O 19-22, adopted November 12, 2019. The purpose of these standards is to prevent or reduce adverse impacts to the drainage system and water resources of the Tualatin River Basin.

Per the above stated code, and preliminary conversations with the City of Sherwood engineering department, a hydromodification category for the site needed to be established to determine allowable methods for treatment and flow-matching detention.

The proposed site is shown in an “Expansion Area” of the Hydromodification Web Map Tool¹, and risk level, based on the point of discharge, is “Moderate”. The project’s new and existing impervious surface for the site totals less than 80,000 SF which puts the project size at “Medium”. Per Table 4-2 in the CWS Design Standards, the combination of these factors puts the proposed project site in Category 3. Category 3 projects may address hydromodification through Peak-Flow Matching Detention and management of at least 30% of the runoff from the site through a LIDA per Table 4-3. Both detention ponds and vegetated swales, as proposed for this site, are approved LIDA for stormwater runoff management.

3- Methodology:

Stormwater runoff values calculated in this report were determined using HydroCAD®, a computer aided design tool utilized for modeling stormwater runoff per the procedures outlined in (TR-55), Urban Hydrology for Small Watersheds, from the United States Department of Agriculture (USDA). This method relies on data gathered from the USDA Soil Conservation Service and standard hydraulics equations. Peak discharges were found in HydroCAD® using the Soil Conservation Services (SCS) method, based on the standard Type 1A rainfall distribution for all storm events. Peak 24-Hour rainfall events for the City of Sherwood were taken from Table 4-4 in the CWS standards.

4- Precipitation:

The design storm events used in this analysis are the 2-Year, 5-Year, 10-Year, and 25-Year recurrence intervals. The 100-Year storm event is included as well for facility sizing. All 24-Hours design storm quantities for each event are distributed over the NRCS Type 1A rainfall distribution. **Table 1** below lists the 24-Hour rainfall design storm events for each recurrence interval as used by the City of Sherwood.

¹ <https://cws.maps.arcgis.com/apps/webappviewer/index.html?id=ab298d7dc7034dfa9f069a226a762e2b>

Table 1: City of Sherwood Design Storms

Storm Event	Inches in 24-hrs
2-year	2.50
5-year	3.10
10-year	3.45
25-year	3.90
100-year	4.50

5- Pre-Development Drainage: (refer to D1: *Pre-development Drainage*)

The pre-development drainage calculations were performed assuming the site is a combination of brush, gravel, and home/driveway structures. A weighted Curve Number (CN) of 77 was established for the pre-development conditions. For Time of Concentration (Tc) on the site, assuming sheet flow over 298 feet of dense grass, was established at 28.3 minutes.

Soils information for the site was taken from the online version of the United States Department of Agriculture (USDA) web soil survey.² 99% of the soils on the site consist of Aloha Silt Loam with only 1% of Huberly Silt Loam (0-3% Slopes). Both soils are HSG Type C/D, which are classified as being somewhat poorly to poorly draining. Type “D” soils were used for the purposes of this site evaluation. The soils map and further information about the soils on the site can be found in Exhibit A.

6- Post-Development Drainage: (refer to D2: *Post-development Drainage*)

The post-development drainage calculations account for the new and existing-to-remain pervious and impervious surfaces that will exist on the site after construction. Per CWS sizing standards, new home construction on single-family lots shall contain a maximum of 2,640 square feet of impervious surface. For 9 new homes, this totals 23,760 SF of impervious surface. Combined with the existing home and driveway-to-remain (new Lot 3), and new ROW improvements for SW Wapato Island Drive, total impervious surfaces for the site are approximately 1 acre. The remaining 1 acre of the site will consist of pervious surfaces such as yards and open space.

Per City of Sherwood requirements, stormwater runoff from individual lots must be directed to the storm sewer system, rather than flowing to the street via weepholes prior to entering the system. Once runoff has entered the system, but prior to being released to the above-ground detention pond between lots 9 and 10, water will enter a Pre-Treatment Manhole, per CWS standard details. Water will flow from the pretreatment manhole to the detention pond, where the stormwater runoff flow rate will be managed using an outlet control manhole, and water quality will be managed using a vegetated swale in the bottom of the detention facility. Further information on water quality treatment methods can be found in Section 7 of this report.

² <https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

Table 2: Summary of HydroCAD® Nodes

Node	Area (acres)	CN	Q ₂ -Year (cfs)	Q ₅ -Year (cfs)	Q ₁₀ -Year (cfs)	Q ₂₅ -Year (cfs)
Pre (1S)	2.00	77	0.21	0.39	0.50	0.66
Post (2S)	2.00	89	0.73	1.02	1.19	1.42
Pond (1P)	n/a	n/a	0.10	0.15	0.20	0.29
Post Total	n/a	n/a	0.10	0.15	0.20	0.29

For Category 3 projects, flow-matching requirements include post-developed runoff of the 2-year storm be released at half the rate of the pre-developed rate for the same storm. The proposed pond and outflow controls achieve this requirement.

The detention facility, designed with vertical walls, has a total available storage capacity of 12,225 cf. The maximum height of the facility is 5 feet, with a maximum ponding depth of 3.63 feet, during the 100-year storm event. Expected storage volumes and maximum elevations for each storm event are presented below in **Table 3**.

Table 3: Storage and Maximum Elevations at Pond 1P

Storm Event	Storage (cf)	Peak Elevation (ft)
2-Year	6,386	202.88
5-Year	7,653	203.37
10-Year	7,896	203.46
25-Year	8,082	203.53
100-Year	8,338	203.63

The upper elevation of the detention facility is designed to be at 205.00. With peak 100-year storm flow elevations reaching 203.63, this means there's more than the minimum 1-foot of freeboard to avoid damage to the facilities or surrounding properties.

7- Water Quality:

Per CWS Standards, vegetated swales are acceptable LIDA for treatment of stormwater runoff. The proposed swale in the detention facility has been sized according to the CWS standards. This swale will treat not only the runoff from the new development but is proposed to treat runoff from Brookman Road. All runoff will first go through a CWS standard Pre-Treatment Manhole before entering the detention facility for treatment and detention before leaving the site and entering the Sherwood public storm drain system.

Vegetated swales must be a minimum of 100 feet in length, with a slope of at least 0.5% and a bottom width of at least 2 feet. The designed vegetated swale for the site is approximately 125 feet in length, at a 0.5% slope, and has a bottom width of 3 feet. This leads to a 11.42-minute residence time for the water quality storm, exceeding the minimum required 9.0-minute residence time per CWS. Further calculations for the vegetated swale can be found in Exhibit B.

8- Conclusion:

Based on this stormwater analysis, stormwater runoff from the proposed development will be effectively managed to comply with all applicable design standards using an above ground detention facility. Post-development peak runoff rates will be attenuated to the pre-development rates for the site. Water quality standards will be met using a vegetated biofiltration swale placed in the detention facility onsite.

Plans to Accompany Report

D1 – Pre-Development Drainage Plan

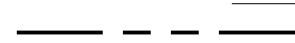
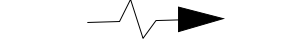

D2 – Post-Development Drainage Plan

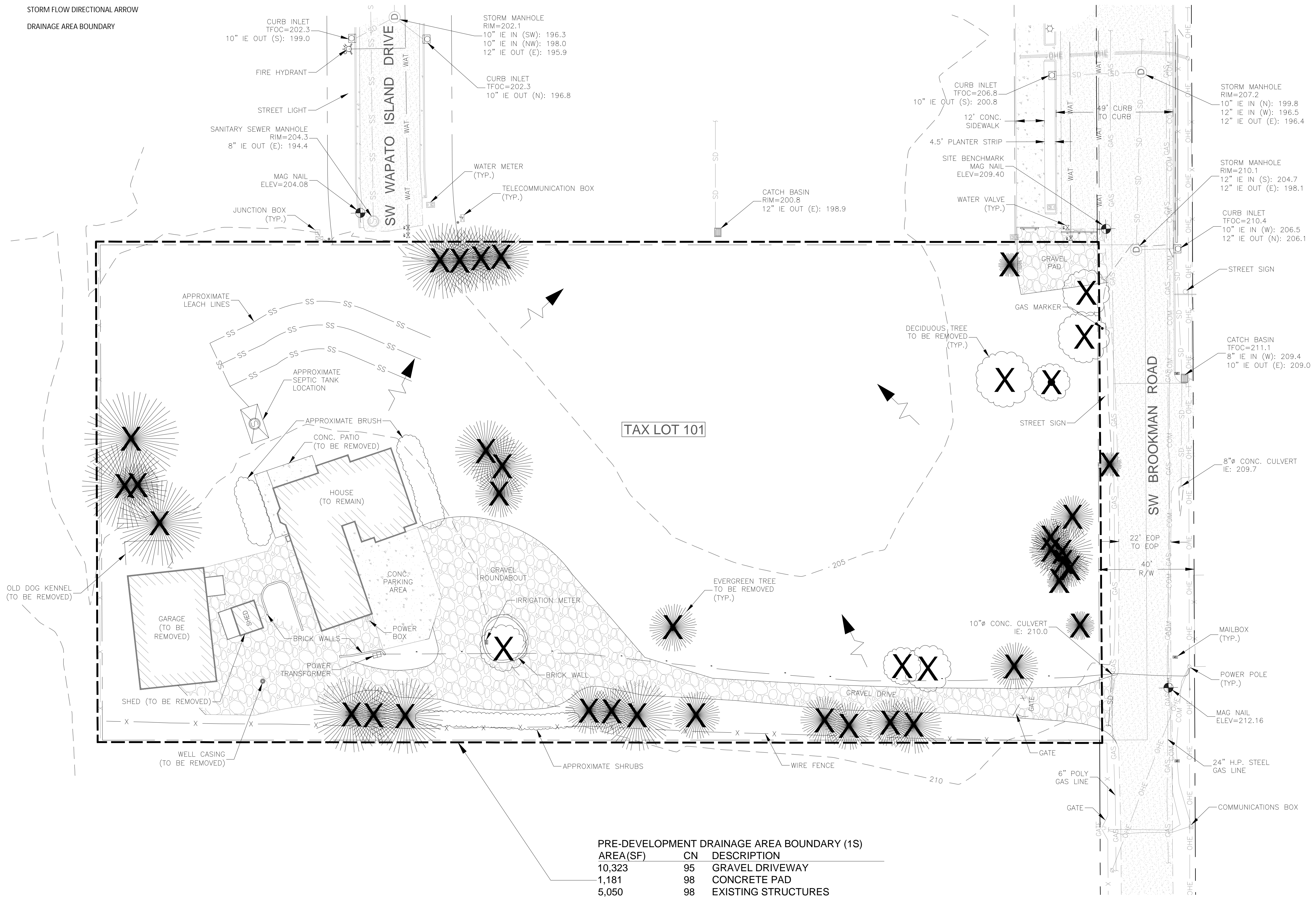
Exhibit A – USGS Soils Map and Soils Information

Exhibit B – Bio-Filtration Swale

HydroCAD® Report

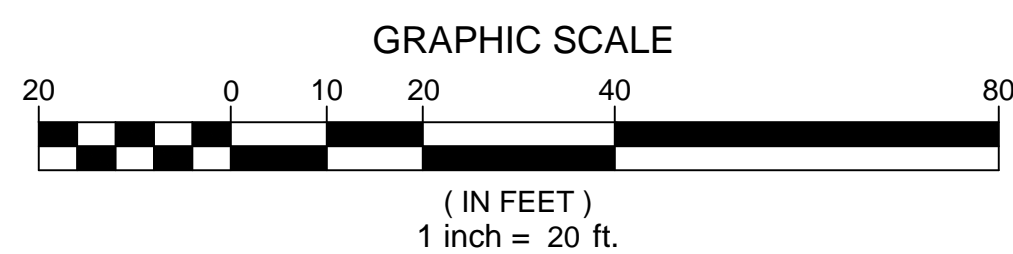
SITE LEGEND

-  SUBJECT PROPERTY LINE
-  STORM FLOW DIRECTIONAL ARROW
-  DRAINAGE AREA BOUNDARY



PRE-DEVELOPMENT DRAINAGE AREA BOUNDARY (1S)

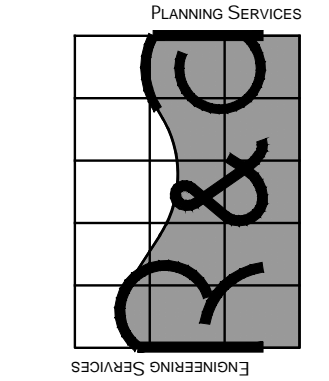
AREA(SF)	CN	DESCRIPTION
10,323	95	GRAVEL DRIVEWAY
1,181	98	CONCRETE PAD
5,050	98	EXISTING STRUCTURES
70,566	65	BRUSH, GOOD, HSG D
87,120	77	WEIGHTED AVERAGE



SITE PLAN
SCALE: 1" = 20'



Reece & Associates, Inc.
321 First Avenue East, Suite 3a
Albany, Oregon 97321
Phone: 541-926-2428
Fax: 541-926-2456



REGISTERED PROFESSIONAL
ENGINEER
11,749
D. J. REECE
RENEWS 12/31/22

**BROOKMAN PLACE STORMWATER EXHIBITS
PRE-DEVELOPMENT DRAINAGE**

OLIVIA BEACH, LLC
SHERWOOD, OREGON

PLAN REVISIONS		
No.	DATE	BY

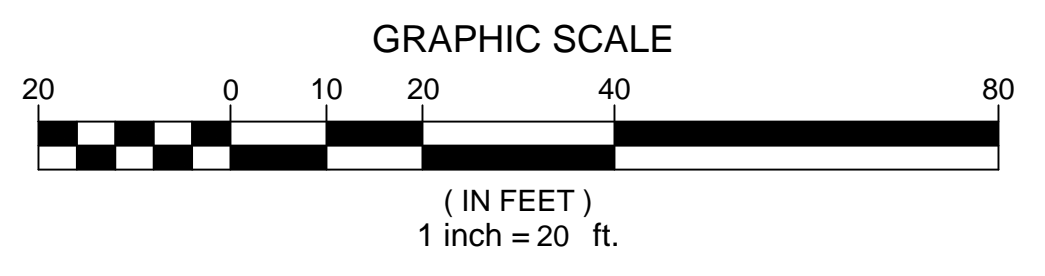
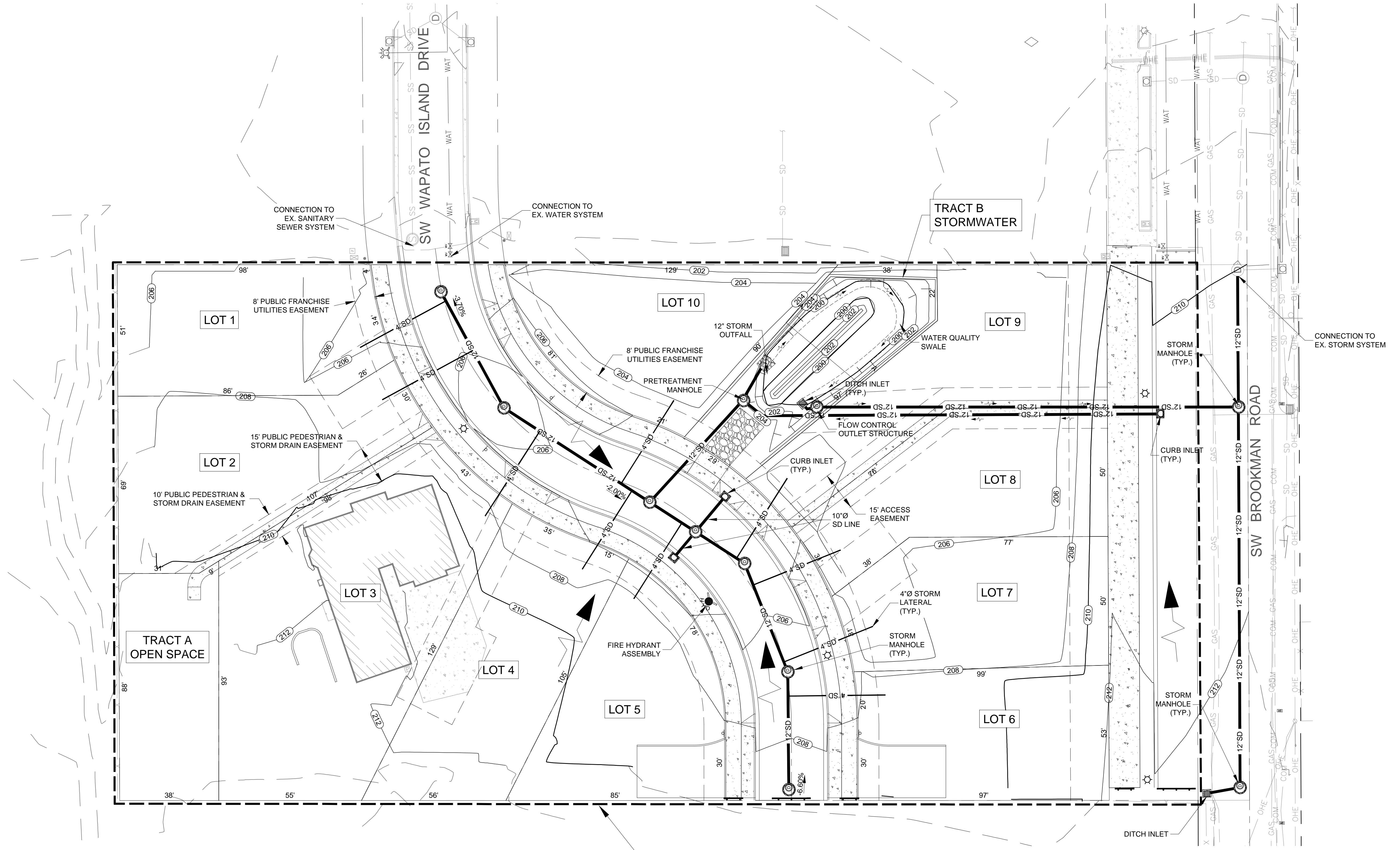
R&A PROJECT NO.
OBC2001
DATE 07/27/2022
DESIGNED A. CECCHINI
ENGINEER D. REECE
CHECKED H. WOOTON
SCALE AS INDICATED

PRELIMINARY - NOT FOR CONSTRUCTION

D1

SITE LEGEND

- SUBJECT PROPERTY LINE
- STORM FLOW DIRECTIONAL ARROW
- - - DRAINAGE AREA BOUNDARY



PRE-DEVELOPMENT DRAINAGE AREA BOUNDARY (2S)

AREA(SF)	CN	DESCRIPTION
43,615	80	75% GRASS COVER, GOOD, HSG D
23,760	98	MAX LOT BUILDABLE
3,865	98	EXISTING STRUCTURES (LOT 3)
15,880	98	HMAC/PCC
87,120	89	WEIGHTED AVERAGE

Reece & Associates, Inc.
 321 First Avenue East, Suite 3a
 Albany, Oregon 97321
 phone: 541-926-2428
 fax: 541-926-2456

PLANNING SERVICES

REGISTERED PROFESSIONAL ENGINEER
 11,749
 D. J. REECE
 RENEWS 12/31/22

**BROOKMAN PLACE STORMWATER EXHIBITS
 POST-DEVELOPMENT DRAINAGE**

OLIVIA BEACH, LLC
 SHERWOOD, OREGON

PLAN REVISIONS

No.	DATE	BY

R&A PROJECT NO.
OBC2001

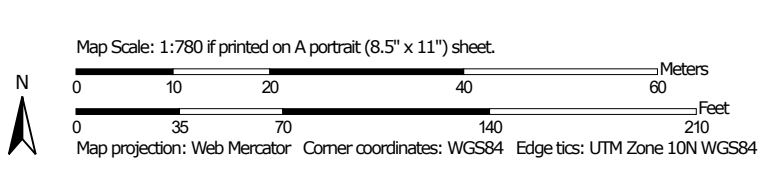
DATE	07/27/2022
DESIGNED	A. CECCHINI
ENGINEER	D. REECE
CHECKED	H. WOOTON
SCALE	AS INDICATED

EXHIBIT A - USGS SOILS MAP

Soil Map—Washington County, Oregon (Sherwood Annexation (Brookman))



Soil Map may not be valid at this scale.





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 1:20,000.

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Washington County, Oregon

Survey Area Data: Version 21, Oct 27, 2021

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

Date(s) aerial images were photographed: Sep 19, 2018—Oct 20, 2018

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
1 HSG C/D	Aloha silt loam	2.0	99.2%
2225A HSG C/D	Huberly silt loam, 0 to 3 percent slopes	0.0	0.8%
Totals for Area of Interest		2.1	100.0%

Map Unit Description

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 in this report, 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, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components 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. Some minor components, however, have properties and behavior 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*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given 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.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Washington County, Oregon

1—Aloha silt loam

Map Unit Setting

National map unit symbol: 21x8

Elevation: 150 to 250 feet

Mean annual precipitation: 40 to 60 inches

Mean annual air temperature: 52 to 54 degrees F

Frost-free period: 160 to 210 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Aloha and similar soils: 90 percent

Minor components: 1 percent

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

Description of Aloha

Setting

Landform: Terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Old loamy alluvium

Typical profile

H1 - 0 to 8 inches: silt loam

H2 - 8 to 46 inches: silt loam

H3 - 46 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Capacity of the most limiting layer to transmit water

(Ksat): Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 18 to 24 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: High (about 11.8 inches)

Interpretive groups

Land capability classification (irrigated): 2w

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: C/D

Ecological site: R002XC007OR - Valley Swale Group

Forage suitability group: Somewhat Poorly Drained

(G002XY005OR)

Other vegetative classification: Somewhat Poorly Drained

(G002XY005OR)

Hydric soil rating: No

Minor Components

Huberly

Percent of map unit: 1 percent

Landform: Terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Other vegetative classification: Poorly Drained (G002XY006OR)

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 21, Oct 27, 2021

Map Unit Description

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 in this report, 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, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components 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. Some minor components, however, have properties and behavior 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*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given 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.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Washington County, Oregon

2225A—Huberly silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2sv3y

Elevation: 150 to 260 feet

Mean annual precipitation: 39 to 51 inches

Mean annual air temperature: 52 to 54 degrees F

Frost-free period: 165 to 210 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Huberly and similar soils: 90 percent

Minor components: 3 percent

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

Description of Huberly

Setting

Landform: Swales on terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Silty glaciolacustrine deposits

Typical profile

A - 0 to 8 inches: silt loam

B_{Ag} - 8 to 15 inches: silt loam

B_{tg} - 15 to 25 inches: silt loam

2B_{tx1} - 25 to 38 inches: silt loam

2B_{tx2} - 38 to 59 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (K_{sat}): Low to moderately low (0.01 to 0.01 in/hr)

Depth to water table: About 0 to 8 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: C/D

Ecological site: R002XC007OR - Valley Swale Group

Forage suitability group: Poorly Drained (G002XY006OR)

Other vegetative classification: Poorly Drained (G002XY006OR)

Hydric soil rating: Yes

Minor Components

Verboort

Percent of map unit: 3 percent

Landform: Terraces

Landform position (three-dimensional): Tread

Down-slope shape: Concave

Across-slope shape: Concave

Other vegetative classification: Poorly Drained (G002XY006OR)

Hydric soil rating: Yes

Data Source Information

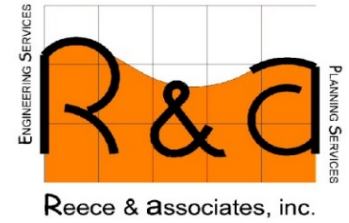
Soil Survey Area: Washington County, Oregon

Survey Area Data: Version 21, Oct 27, 2021

EXHIBIT B - BIO-FILTRATION SWALE

Date: 7/27/2022

Project: OBC2001 - Sherwood



Swale #: 1P Color Key: Calculated Entered Constant

Biofiltration Swale Design

Design Storms Runoff (cfs)	
100-yr	1.73
WQ	0.26

Minimum Bottom Width [ft]	DESIGN Bottom Width [ft]	Mannings n	Check 0.17 Depth [ft]	2" [0.17] = frequently mowed 4" [0.33] = not frequently mowed	Slope [%] (S < 1.5% requires an underdrain)	
3.14	3	0.2	0.33	0.5%	OK!	

Minimum Swale Len (FT)	DESIGN Swale Len (FT)	Area (sf)	Velocity	Side slope:	
98.5	125	1.4256	0.182	4 :1	
				Max = 1 fps	OK!

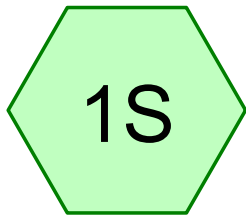
Velocity [ft/sec]	Residence Time Mins.	100 year velocity check
0.182	11.42	Q100= 1.73 OK! V100= 1.21 FPS < 3.0 FPS?

Source: Calculations used in this spreadsheet were developed based on the Methods of Analysis presented in chapter 6.1.1.1 of the 2009 Surface Water Design Manual for King County, Washington.

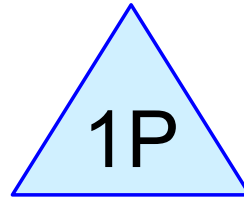
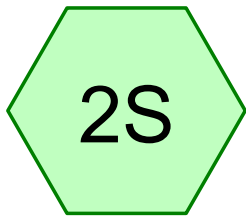
High flow rate capacity check:

Wetted P :	3.66	FT				
RH:	0.39					
			A	R ^{0.67}	S ^{0.5}	
	1.49		1.4256	0.53167486	0.0707107	2.00 CFS
	0.04					

$$Q = \frac{1.49}{n} AR^{0.67} S^{0.5}$$

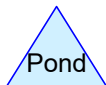
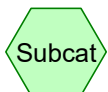


Pre-Development



Post-Development

Tract B Detention Pond



OBC2001 Storm Prelim 072722

Prepared by Reece & Associates, Inc

Printed 7/28/2022

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type IA 24-hr		Default	24.00	1	2.50	2
2	5-Year	Type IA 24-hr		Default	24.00	1	3.10	2
3	10-Year	Type IA 24-hr		Default	24.00	1	3.45	2
4	25-Year	Type IA 24-hr		Default	24.00	1	3.90	2
5	100-Year	Type IA 24-hr		Default	24.00	1	4.50	2
6	WQ 1"	Type IA 24-hr		Trim	4.00	1	1.00	2

OBC2001 Storm Prelim 072722

Type IA 24-hr 2-Year Rainfall=2.50"

Prepared by Reece & Associates, Inc

Printed 7/28/2022

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Page 3

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Development Runoff Area=87,120 sf 7.15% Impervious Runoff Depth=0.74"
Flow Length=298' Slope=0.0436 '/' Tc=28.3 min CN=77 Runoff=0.21 cfs 0.123 af

Subcatchment2S: Post-Development Runoff Area=87,120 sf 49.94% Impervious Runoff Depth=1.45"
Flow Length=250' Slope=0.0320 '/' Tc=1.1 min CN=89 Runoff=0.73 cfs 0.242 af

Pond 1P: Tract B Detention Pond Peak Elev=202.88' Storage=6,386 cf Inflow=0.73 cfs 0.242 af
Outflow=0.10 cfs 0.205 af

Total Runoff Area = 4.000 ac Runoff Volume = 0.366 af Average Runoff Depth = 1.10"
71.46% Pervious = 2.858 ac 28.54% Impervious = 1.142 ac

Summary for Subcatchment 1S: Pre-Development

Runoff = 0.21 cfs @ 8.27 hrs, Volume= 0.123 af, Depth= 0.74"

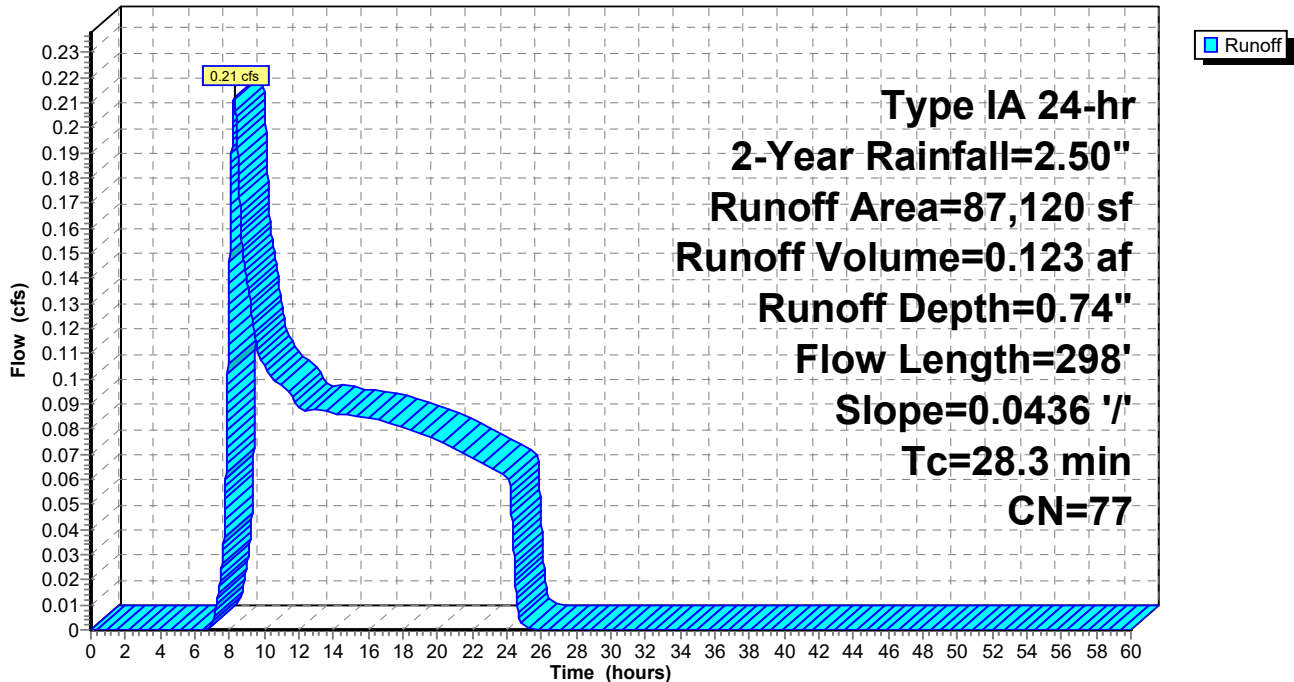
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr 2-Year Rainfall=2.50"

	Area (sf)	CN	Description
*	10,323	95	Gravel Driveway
*	1,181	98	Concrete Pad
*	5,050	98	Structures
	70,566	73	Brush, Good, HSG D
	87,120	77	Weighted Average
	80,889		92.85% Pervious Area
	6,231		7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	298	0.0436	0.18		Sheet Flow, Pre-Sheet Grass: Dense n= 0.240 P2= 2.50"

Subcatchment 1S: Pre-Development

Hydrograph



Summary for Subcatchment 2S: Post-Development

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.73 cfs @ 7.88 hrs, Volume= 0.242 af, Depth= 1.45"
 Routed to Pond 1P : Tract B Detention Pond

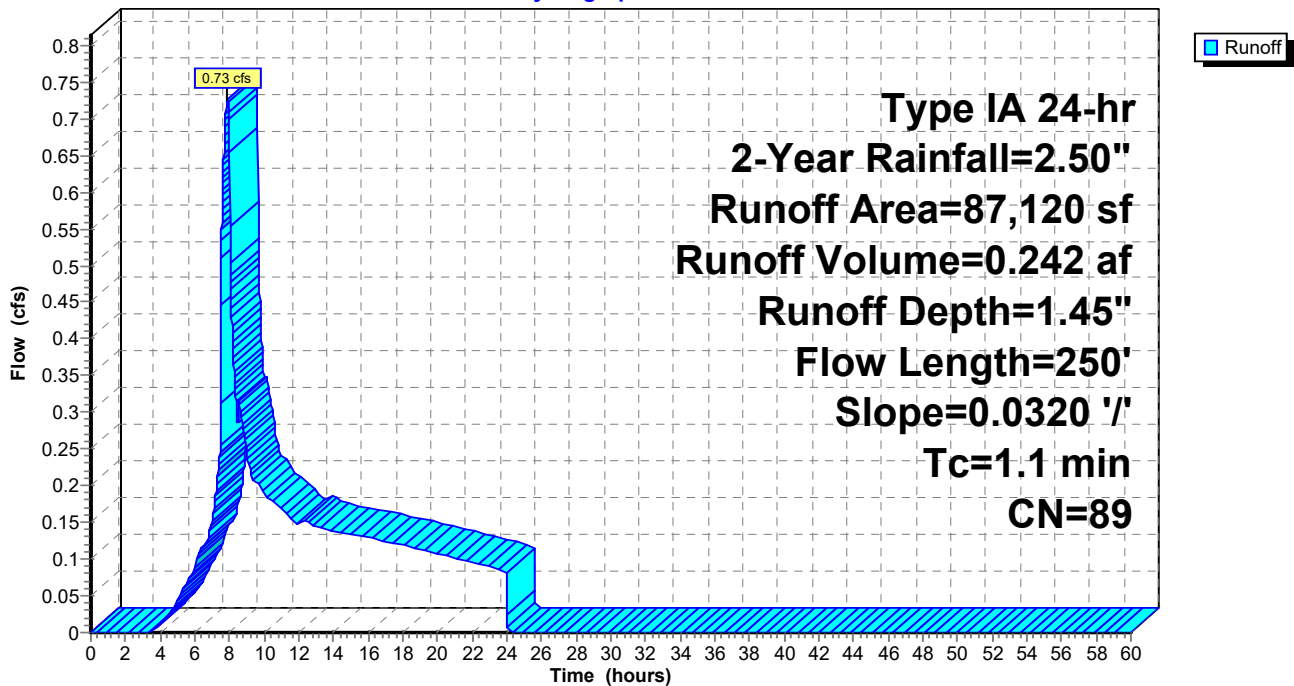
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr 2-Year Rainfall=2.50"

Area (sf)	CN	Description
43,615	80	>75% Grass cover, Good, HSG D
* 23,760	98	Max Lot Buildable
* 15,880	98	ROW
* 3,865	98	Existing (Lot 3)
87,120	89	Weighted Average
43,615		50.06% Pervious Area
43,505		49.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	250	0.0320	3.63		Shallow Concentrated Flow, Post-Conc. Flow Paved Kv= 20.3 fps

Subcatchment 2S: Post-Development

Hydrograph



Summary for Pond 1P: Tract B Detention Pond

Inflow Area = 2.000 ac, 49.94% Impervious, Inflow Depth = 1.45" for 2-Year event
 Inflow = 0.73 cfs @ 7.88 hrs, Volume= 0.242 af
 Outflow = 0.10 cfs @ 21.05 hrs, Volume= 0.205 af, Atten= 86%, Lag= 790.4 min
 Primary = 0.10 cfs @ 21.05 hrs, Volume= 0.205 af
 Routed to nonexistent node 2R

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Peak Elev= 202.88' @ 21.05 hrs Surf.Area= 2,540 sf Storage= 6,386 cf

Plug-Flow detention time= 1,053.3 min calculated for 0.205 af (84% of inflow)
 Center-of-Mass det. time= 957.1 min (1,728.4 - 771.3)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	12,225 cf	Detention Facility (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	1,850	0	0
202.00	2,375	4,225	4,225
204.00	2,750	5,125	9,350
205.00	3,000	2,875	12,225

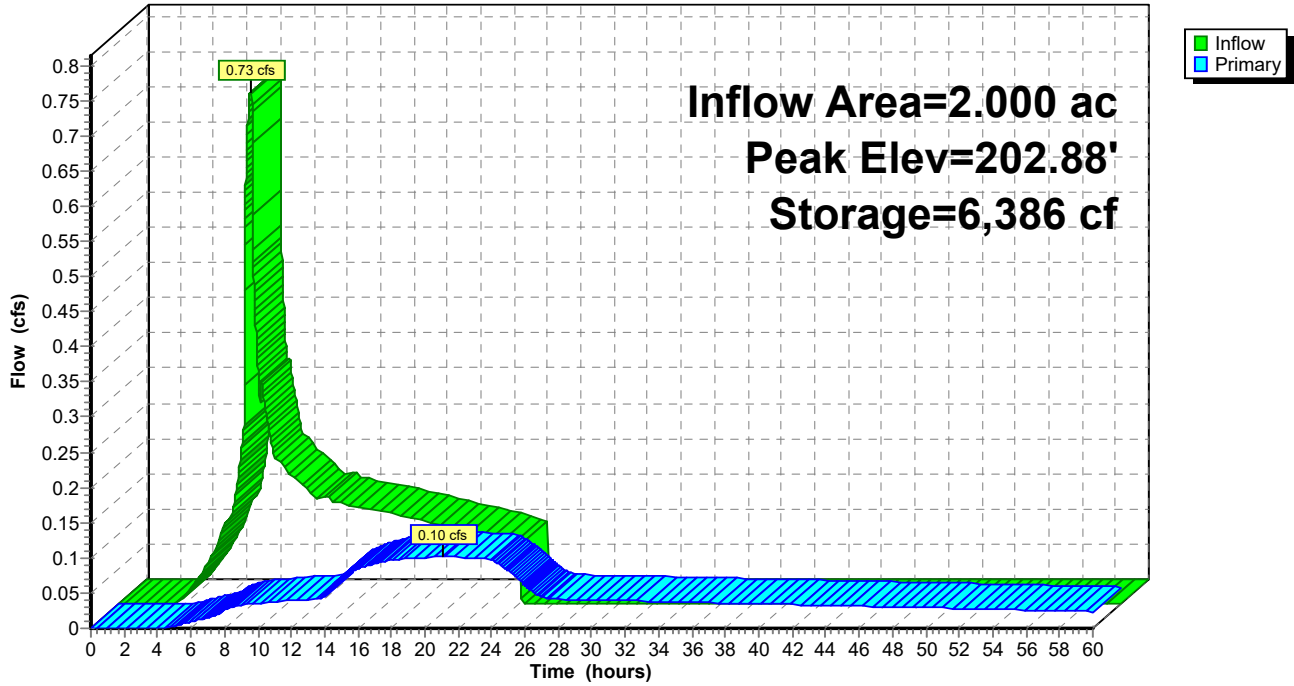
Device	Routing	Invert	Outlet Devices
#1	Primary	200.00'	12.0" Vert. 12" Private Storm Easement C= 0.600 Limited to weir flow at low heads
#2	Device 1	200.00'	1.0" Vert. 1" Weep Hole C= 0.600 Limited to weir flow at low heads
#3	Device 1	202.50'	2.0" Vert. 2" Outlet C= 0.600 Limited to weir flow at low heads
#4	Device 1	203.35'	12.0" Vert. 12" Outlet C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.10 cfs @ 21.05 hrs HW=202.88' (Free Discharge)

- ↑ 1=12" Private Storm Easement (Passes 0.10 cfs of 5.83 cfs potential flow)
- ↑ 2=1" Weep Hole (Orifice Controls 0.04 cfs @ 8.11 fps)
- ↑ 3=2" Outlet (Orifice Controls 0.06 cfs @ 2.62 fps)
- ↑ 4=12" Outlet (Controls 0.00 cfs)

Pond 1P: Tract B Detention Pond

Hydrograph



OBC2001 Storm Prelim 072722

Type IA 24-hr 5-Year Rainfall=3.10"

Prepared by Reece & Associates, Inc

Printed 7/28/2022

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Page 8

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Development Runoff Area=87,120 sf 7.15% Impervious Runoff Depth=1.14"
Flow Length=298' Slope=0.0436 '/' Tc=28.3 min CN=77 Runoff=0.39 cfs 0.190 af

Subcatchment2S: Post-Development Runoff Area=87,120 sf 49.94% Impervious Runoff Depth=1.99"
Flow Length=250' Slope=0.0320 '/' Tc=1.1 min CN=89 Runoff=1.02 cfs 0.332 af

Pond 1P: Tract B Detention Pond Peak Elev=203.37' Storage=7,653 cf Inflow=1.02 cfs 0.332 af
Outflow=0.15 cfs 0.289 af

Total Runoff Area = 4.000 ac Runoff Volume = 0.522 af Average Runoff Depth = 1.57"
71.46% Pervious = 2.858 ac 28.54% Impervious = 1.142 ac

Summary for Subcatchment 1S: Pre-Development

Runoff = 0.39 cfs @ 8.26 hrs, Volume= 0.190 af, Depth= 1.14"

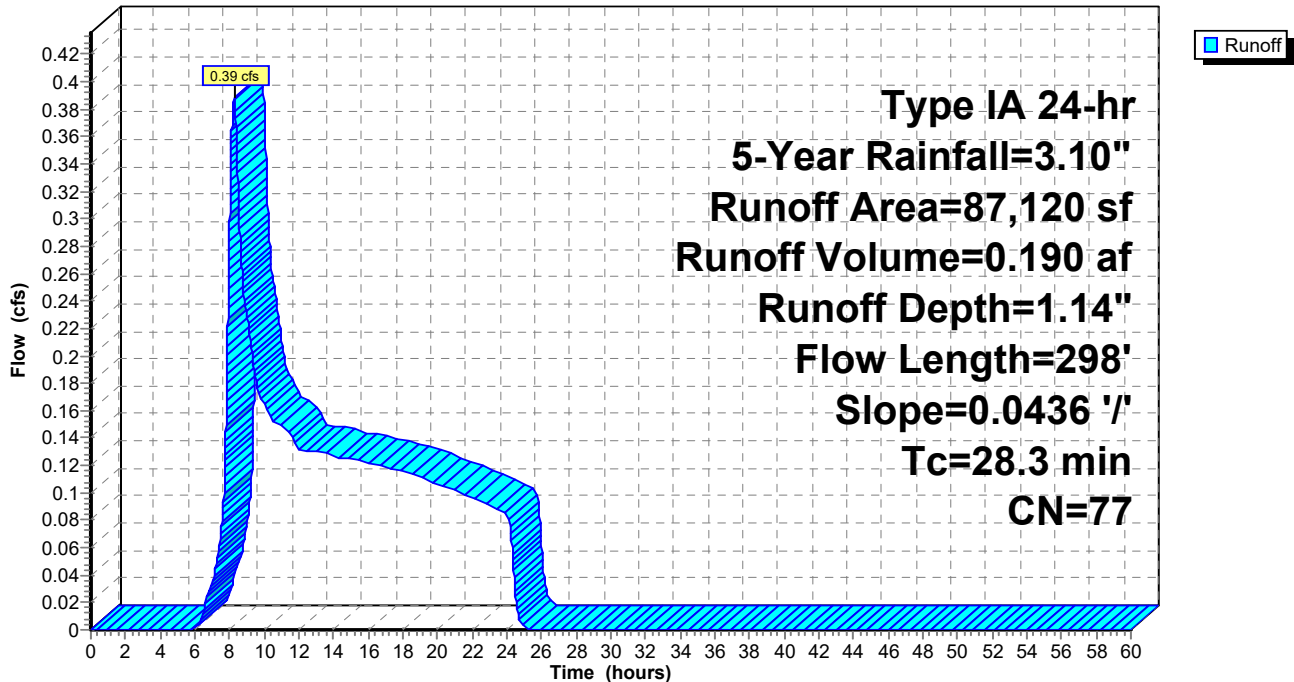
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr 5-Year Rainfall=3.10"

	Area (sf)	CN	Description
*	10,323	95	Gravel Driveway
*	1,181	98	Concrete Pad
*	5,050	98	Structures
	70,566	73	Brush, Good, HSG D
	87,120	77	Weighted Average
	80,889		92.85% Pervious Area
	6,231		7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	298	0.0436	0.18		Sheet Flow, Pre-Sheet Grass: Dense n= 0.240 P2= 2.50"

Subcatchment 1S: Pre-Development

Hydrograph



Summary for Subcatchment 2S: Post-Development

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.02 cfs @ 7.86 hrs, Volume= 0.332 af, Depth= 1.99"
 Routed to Pond 1P : Tract B Detention Pond

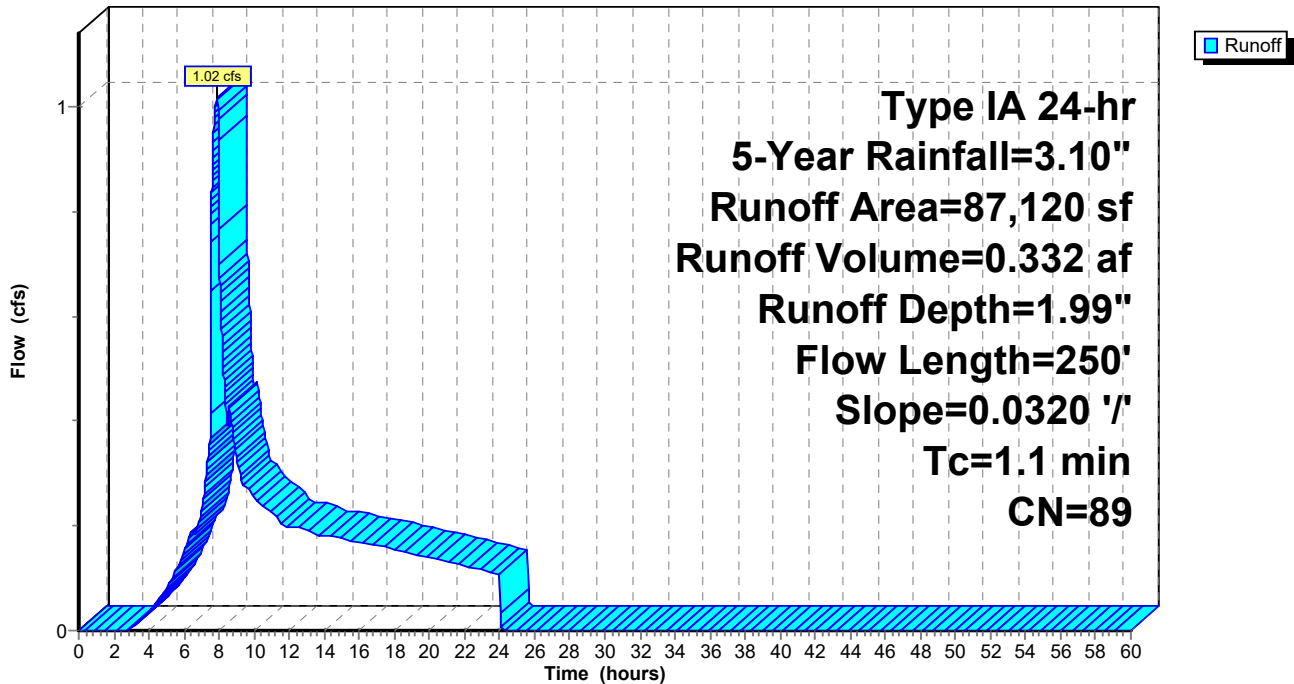
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr 5-Year Rainfall=3.10"

Area (sf)	CN	Description
43,615	80	>75% Grass cover, Good, HSG D
* 23,760	98	Max Lot Buildable
* 15,880	98	ROW
* 3,865	98	Existing (Lot 3)
87,120	89	Weighted Average
43,615		50.06% Pervious Area
43,505		49.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	250	0.0320	3.63		Shallow Concentrated Flow, Post-Conc. Flow Paved Kv= 20.3 fps

Subcatchment 2S: Post-Development

Hydrograph



Summary for Pond 1P: Tract B Detention Pond

Inflow Area = 2.000 ac, 49.94% Impervious, Inflow Depth = 1.99" for 5-Year event
 Inflow = 1.02 cfs @ 7.86 hrs, Volume= 0.332 af
 Outflow = 0.15 cfs @ 19.24 hrs, Volume= 0.289 af, Atten= 86%, Lag= 682.5 min
 Primary = 0.15 cfs @ 19.24 hrs, Volume= 0.289 af
 Routed to nonexistent node 2R

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Peak Elev= 203.37' @ 19.24 hrs Surf.Area= 2,632 sf Storage= 7,653 cf

Plug-Flow detention time= 889.7 min calculated for 0.289 af (87% of inflow)
 Center-of-Mass det. time= 807.1 min (1,560.5 - 753.4)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	12,225 cf	Detention Facility (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	1,850	0	0
202.00	2,375	4,225	4,225
204.00	2,750	5,125	9,350
205.00	3,000	2,875	12,225

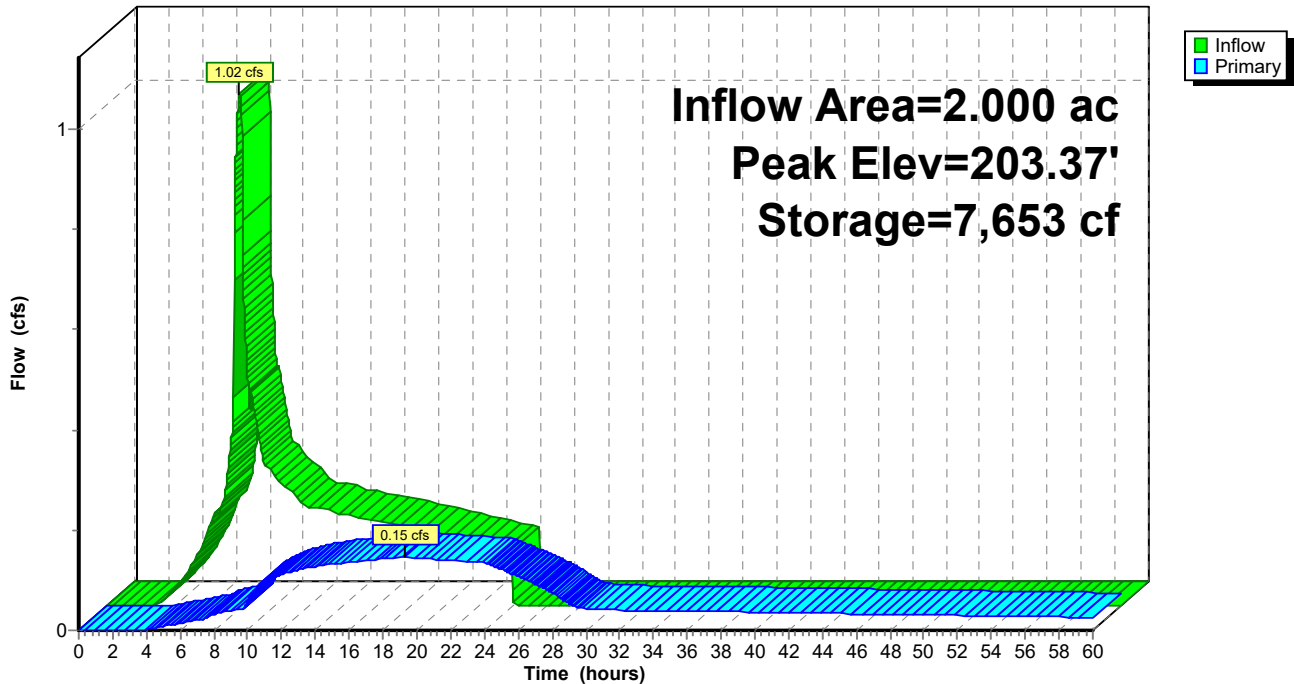
Device	Routing	Invert	Outlet Devices
#1	Primary	200.00'	12.0" Vert. 12" Private Storm Easement C= 0.600 Limited to weir flow at low heads
#2	Device 1	200.00'	1.0" Vert. 1" Weep Hole C= 0.600 Limited to weir flow at low heads
#3	Device 1	202.50'	2.0" Vert. 2" Outlet C= 0.600 Limited to weir flow at low heads
#4	Device 1	203.35'	12.0" Vert. 12" Outlet C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.14 cfs @ 19.24 hrs HW=203.37' (Free Discharge)

- ↑ 1=12" Private Storm Easement (Passes 0.14 cfs of 6.41 cfs potential flow)
- ↑ 2=1" Weep Hole (Orifice Controls 0.05 cfs @ 8.78 fps)
- ↑ 3=2" Outlet (Orifice Controls 0.09 cfs @ 4.27 fps)
- ↑ 4=12" Outlet (Orifice Controls 0.00 cfs @ 0.47 fps)

Pond 1P: Tract B Detention Pond

Hydrograph



OBC2001 Storm Prelim 072722

Type IA 24-hr 10-Year Rainfall=3.45"

Prepared by Reece & Associates, Inc

Printed 7/28/2022

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Page 13

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Development Runoff Area=87,120 sf 7.15% Impervious Runoff Depth=1.39"
Flow Length=298' Slope=0.0436 '/' Tc=28.3 min CN=77 Runoff=0.50 cfs 0.232 af

Subcatchment2S: Post-Development Runoff Area=87,120 sf 49.94% Impervious Runoff Depth=2.31"
Flow Length=250' Slope=0.0320 '/' Tc=1.1 min CN=89 Runoff=1.19 cfs 0.385 af

Pond 1P: Tract B Detention Pond Peak Elev=203.46' Storage=7,896 cf Inflow=1.19 cfs 0.385 af
Outflow=0.20 cfs 0.341 af

Total Runoff Area = 4.000 ac Runoff Volume = 0.617 af Average Runoff Depth = 1.85"
71.46% Pervious = 2.858 ac 28.54% Impervious = 1.142 ac

Summary for Subcatchment 1S: Pre-Development

Runoff = 0.50 cfs @ 8.24 hrs, Volume= 0.232 af, Depth= 1.39"

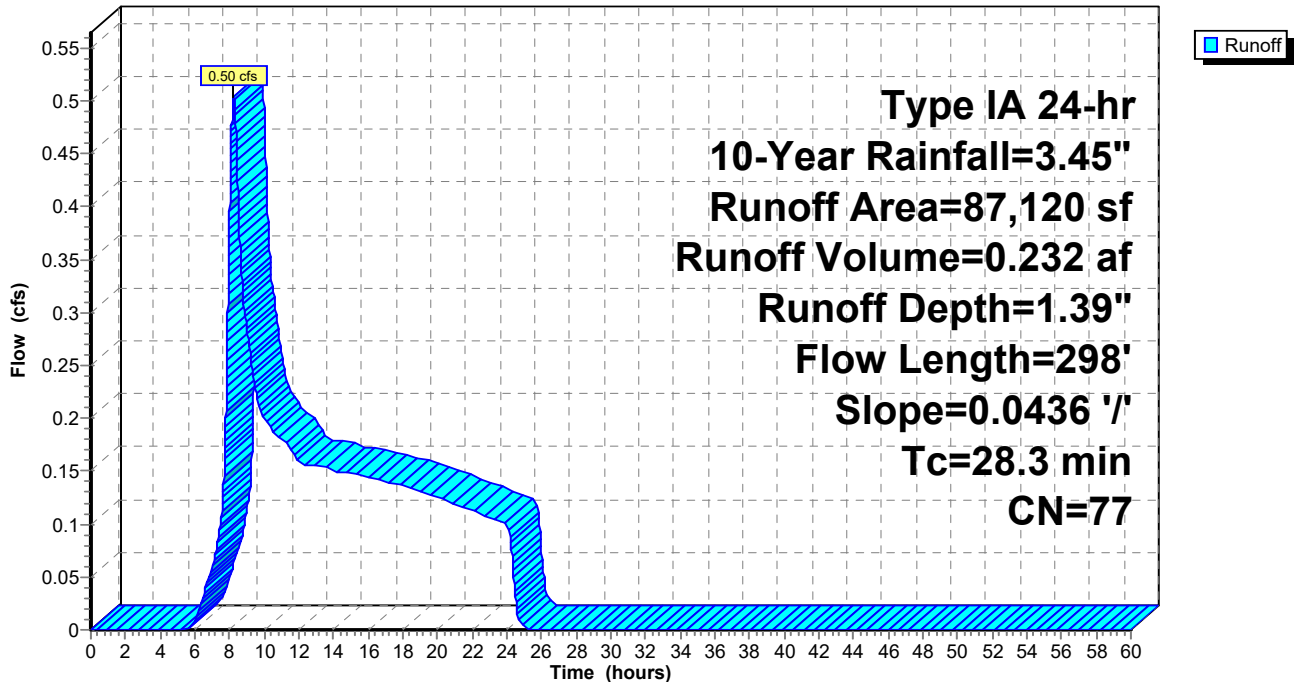
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-Year Rainfall=3.45"

	Area (sf)	CN	Description
*	10,323	95	Gravel Driveway
*	1,181	98	Concrete Pad
*	5,050	98	Structures
	70,566	73	Brush, Good, HSG D
	87,120	77	Weighted Average
	80,889		92.85% Pervious Area
	6,231		7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	298	0.0436	0.18		Sheet Flow, Pre-Sheet Grass: Dense n= 0.240 P2= 2.50"

Subcatchment 1S: Pre-Development

Hydrograph



Summary for Subcatchment 2S: Post-Development

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.19 cfs @ 7.85 hrs, Volume= 0.385 af, Depth= 2.31"
 Routed to Pond 1P : Tract B Detention Pond

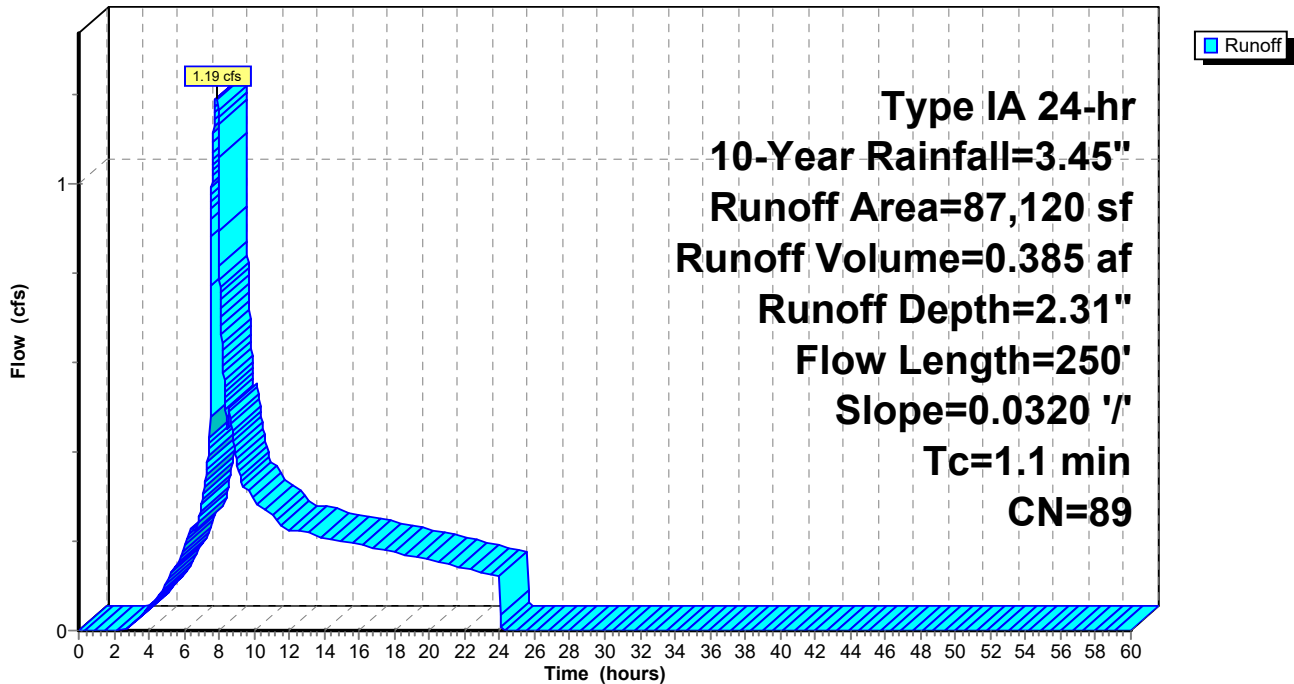
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr 10-Year Rainfall=3.45"

Area (sf)	CN	Description
43,615	80	>75% Grass cover, Good, HSG D
* 23,760	98	Max Lot Buildable
* 15,880	98	ROW
* 3,865	98	Existing (Lot 3)
87,120	89	Weighted Average
43,615		50.06% Pervious Area
43,505		49.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	250	0.0320	3.63		Shallow Concentrated Flow, Post-Conc. Flow Paved Kv= 20.3 fps

Subcatchment 2S: Post-Development

Hydrograph



Summary for Pond 1P: Tract B Detention Pond

Inflow Area = 2.000 ac, 49.94% Impervious, Inflow Depth = 2.31" for 10-Year event
 Inflow = 1.19 cfs @ 7.85 hrs, Volume= 0.385 af
 Outflow = 0.20 cfs @ 14.60 hrs, Volume= 0.341 af, Atten= 83%, Lag= 404.8 min
 Primary = 0.20 cfs @ 14.60 hrs, Volume= 0.341 af
 Routed to nonexistent node 2R

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Peak Elev= 203.46' @ 14.60 hrs Surf.Area= 2,649 sf Storage= 7,896 cf

Plug-Flow detention time= 794.1 min calculated for 0.341 af (89% of inflow)
 Center-of-Mass det. time= 720.5 min (1,465.6 - 745.1)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	12,225 cf	Detention Facility (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	1,850	0	0
202.00	2,375	4,225	4,225
204.00	2,750	5,125	9,350
205.00	3,000	2,875	12,225

Device	Routing	Invert	Outlet Devices
#1	Primary	200.00'	12.0" Vert. 12" Private Storm Easement C= 0.600 Limited to weir flow at low heads
#2	Device 1	200.00'	1.0" Vert. 1" Weep Hole C= 0.600 Limited to weir flow at low heads
#3	Device 1	202.50'	2.0" Vert. 2" Outlet C= 0.600 Limited to weir flow at low heads
#4	Device 1	203.35'	12.0" Vert. 12" Outlet C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.20 cfs @ 14.60 hrs HW=203.46' (Free Discharge)

↑ **1=12" Private Storm Easement** (Passes 0.20 cfs of 6.51 cfs potential flow)

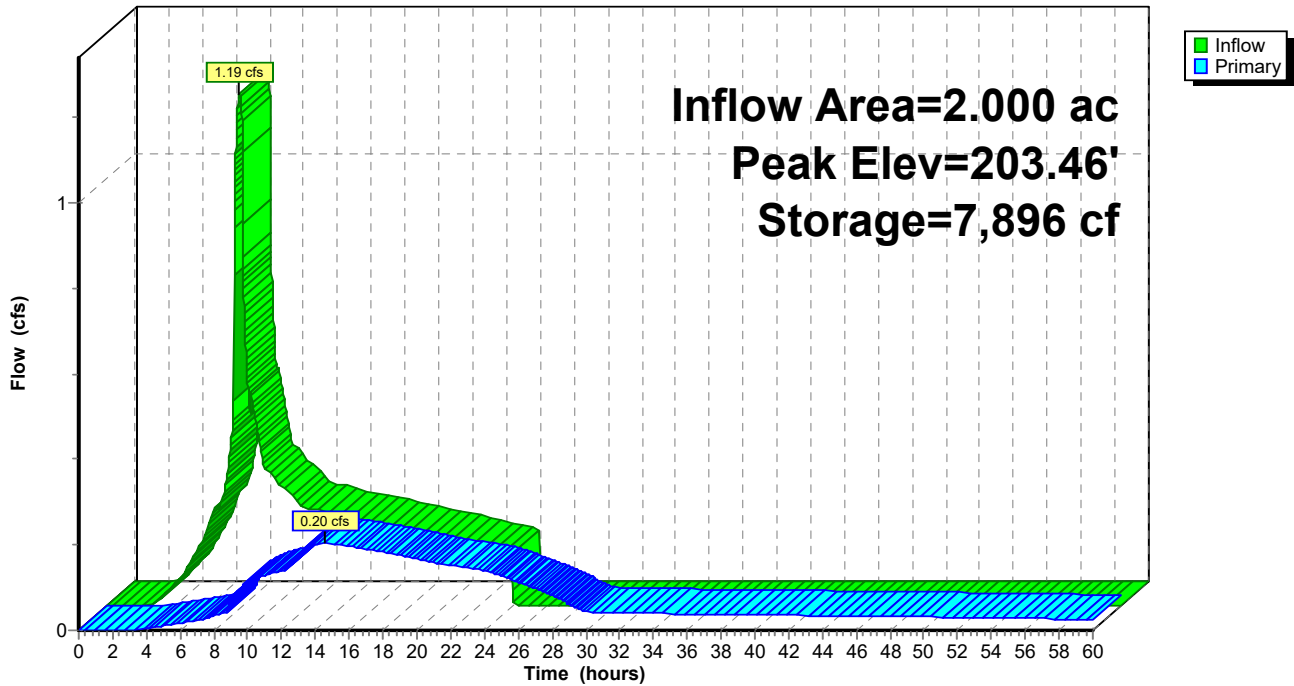
↑ **2=1" Weep Hole** (Orifice Controls 0.05 cfs @ 8.90 fps)

↑ **3=2" Outlet** (Orifice Controls 0.10 cfs @ 4.51 fps)

↑ **4=12" Outlet** (Orifice Controls 0.05 cfs @ 1.14 fps)

Pond 1P: Tract B Detention Pond

Hydrograph



OBC2001 Storm Prelim 072722

Type IA 24-hr 25-Year Rainfall=3.90"

Prepared by Reece & Associates, Inc

Printed 7/28/2022

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Page 18

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Development Runoff Area=87,120 sf 7.15% Impervious Runoff Depth=1.73"
Flow Length=298' Slope=0.0436 '/' Tc=28.3 min CN=77 Runoff=0.66 cfs 0.289 af

Subcatchment2S: Post-Development Runoff Area=87,120 sf 49.94% Impervious Runoff Depth=2.73"
Flow Length=250' Slope=0.0320 '/' Tc=1.1 min CN=89 Runoff=1.42 cfs 0.455 af

Pond 1P: Tract B Detention Pond Peak Elev=203.53' Storage=8,082 cf Inflow=1.42 cfs 0.455 af
Outflow=0.29 cfs 0.411 af

Total Runoff Area = 4.000 ac Runoff Volume = 0.744 af Average Runoff Depth = 2.23"
71.46% Pervious = 2.858 ac 28.54% Impervious = 1.142 ac

OBC2001 Storm Prelim 072722

Prepared by Reece & Associates, Inc

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Type IA 24-hr 25-Year Rainfall=3.90"

Printed 7/28/2022

Page 19

Summary for Subcatchment 1S: Pre-Development

Runoff = 0.66 cfs @ 8.22 hrs, Volume= 0.289 af, Depth= 1.73"

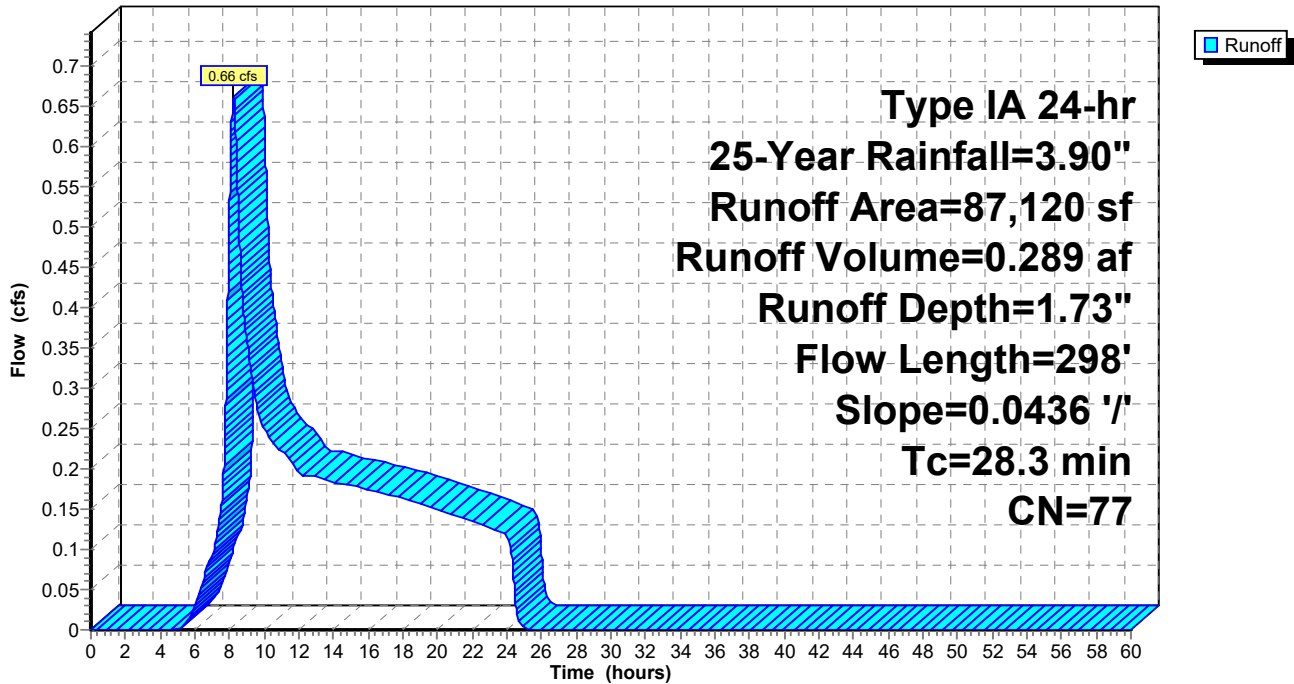
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-Year Rainfall=3.90"

	Area (sf)	CN	Description
*	10,323	95	Gravel Driveway
*	1,181	98	Concrete Pad
*	5,050	98	Structures
	70,566	73	Brush, Good, HSG D
	87,120	77	Weighted Average
	80,889		92.85% Pervious Area
	6,231		7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	298	0.0436	0.18		Sheet Flow, Pre-Sheet Grass: Dense n= 0.240 P2= 2.50"

Subcatchment 1S: Pre-Development

Hydrograph



Summary for Subcatchment 2S: Post-Development

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.42 cfs @ 7.85 hrs, Volume= 0.455 af, Depth= 2.73"
 Routed to Pond 1P : Tract B Detention Pond

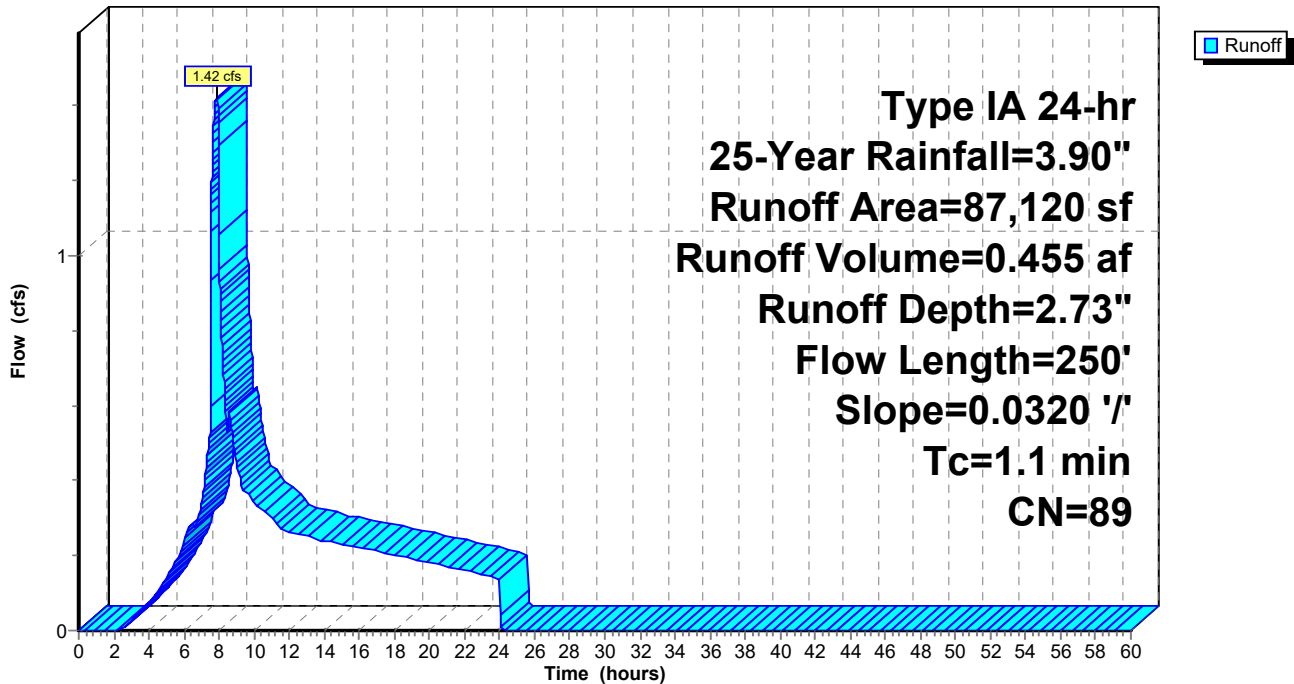
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr 25-Year Rainfall=3.90"

Area (sf)	CN	Description
43,615	80	>75% Grass cover, Good, HSG D
* 23,760	98	Max Lot Buildable
* 15,880	98	ROW
* 3,865	98	Existing (Lot 3)
87,120	89	Weighted Average
43,615		50.06% Pervious Area
43,505		49.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	250	0.0320	3.63		Shallow Concentrated Flow, Post-Conc. Flow Paved Kv= 20.3 fps

Subcatchment 2S: Post-Development

Hydrograph



Summary for Pond 1P: Tract B Detention Pond

Inflow Area = 2.000 ac, 49.94% Impervious, Inflow Depth = 2.73" for 25-Year event
 Inflow = 1.42 cfs @ 7.85 hrs, Volume= 0.455 af
 Outflow = 0.29 cfs @ 11.14 hrs, Volume= 0.411 af, Atten= 79%, Lag= 197.6 min
 Primary = 0.29 cfs @ 11.14 hrs, Volume= 0.411 af
 Routed to nonexistent node 2R

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Peak Elev= 203.53' @ 11.14 hrs Surf.Area= 2,662 sf Storage= 8,082 cf

Plug-Flow detention time= 686.5 min calculated for 0.411 af (90% of inflow)
 Center-of-Mass det. time= 622.0 min (1,358.2 - 736.2)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	12,225 cf	Detention Facility (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	1,850	0	0
202.00	2,375	4,225	4,225
204.00	2,750	5,125	9,350
205.00	3,000	2,875	12,225

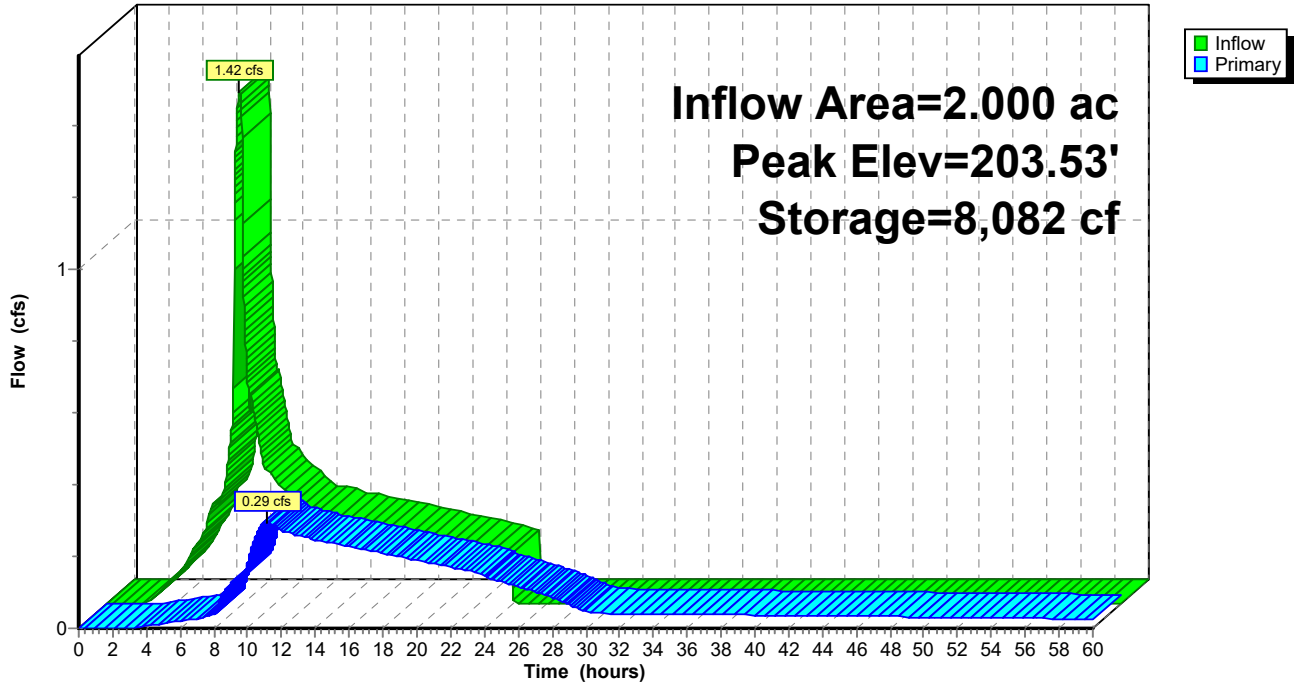
Device	Routing	Invert	Outlet Devices
#1	Primary	200.00'	12.0" Vert. 12" Private Storm Easement C= 0.600 Limited to weir flow at low heads
#2	Device 1	200.00'	1.0" Vert. 1" Weep Hole C= 0.600 Limited to weir flow at low heads
#3	Device 1	202.50'	2.0" Vert. 2" Outlet C= 0.600 Limited to weir flow at low heads
#4	Device 1	203.35'	12.0" Vert. 12" Outlet C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.29 cfs @ 11.14 hrs HW=203.53' (Free Discharge)

- ↑ 1=12" Private Storm Easement (Passes 0.29 cfs of 6.58 cfs potential flow)
- ↑ 2=1" Weep Hole (Orifice Controls 0.05 cfs @ 8.99 fps)
- ↑ 3=2" Outlet (Orifice Controls 0.10 cfs @ 4.69 fps)
- ↑ 4=12" Outlet (Orifice Controls 0.14 cfs @ 1.45 fps)

Pond 1P: Tract B Detention Pond

Hydrograph



OBC2001 Storm Prelim 072722

Type IA 24-hr 100-Year Rainfall=4.50"

Prepared by Reece & Associates, Inc

Printed 7/28/2022

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Page 23

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Development Runoff Area=87,120 sf 7.15% Impervious Runoff Depth=2.21"
Flow Length=298' Slope=0.0436 '/' Tc=28.3 min CN=77 Runoff=0.89 cfs 0.368 af

Subcatchment2S: Post-Development Runoff Area=87,120 sf 49.94% Impervious Runoff Depth=3.30"
Flow Length=250' Slope=0.0320 '/' Tc=1.1 min CN=89 Runoff=1.73 cfs 0.549 af

Pond 1P: Tract B Detention Pond Peak Elev=203.63' Storage=8,338 cf Inflow=1.73 cfs 0.549 af
Outflow=0.48 cfs 0.505 af

Total Runoff Area = 4.000 ac Runoff Volume = 0.918 af Average Runoff Depth = 2.75"
71.46% Pervious = 2.858 ac 28.54% Impervious = 1.142 ac

Summary for Subcatchment 1S: Pre-Development

Runoff = 0.89 cfs @ 8.21 hrs, Volume= 0.368 af, Depth= 2.21"

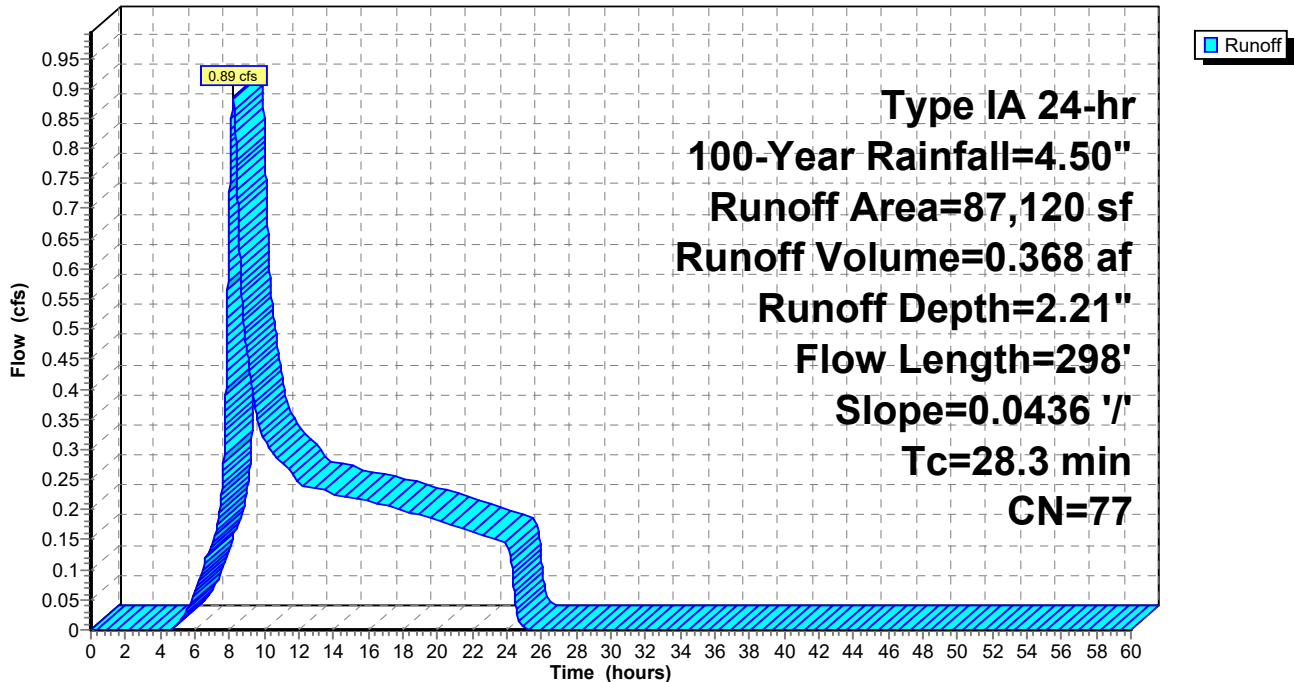
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-Year Rainfall=4.50"

	Area (sf)	CN	Description
*	10,323	95	Gravel Driveway
*	1,181	98	Concrete Pad
*	5,050	98	Structures
	70,566	73	Brush, Good, HSG D
	87,120	77	Weighted Average
	80,889		92.85% Pervious Area
	6,231		7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	298	0.0436	0.18		Sheet Flow, Pre-Sheet Grass: Dense n= 0.240 P2= 2.50"

Subcatchment 1S: Pre-Development

Hydrograph



Summary for Subcatchment 2S: Post-Development

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.73 cfs @ 7.84 hrs, Volume= 0.549 af, Depth= 3.30"
 Routed to Pond 1P : Tract B Detention Pond

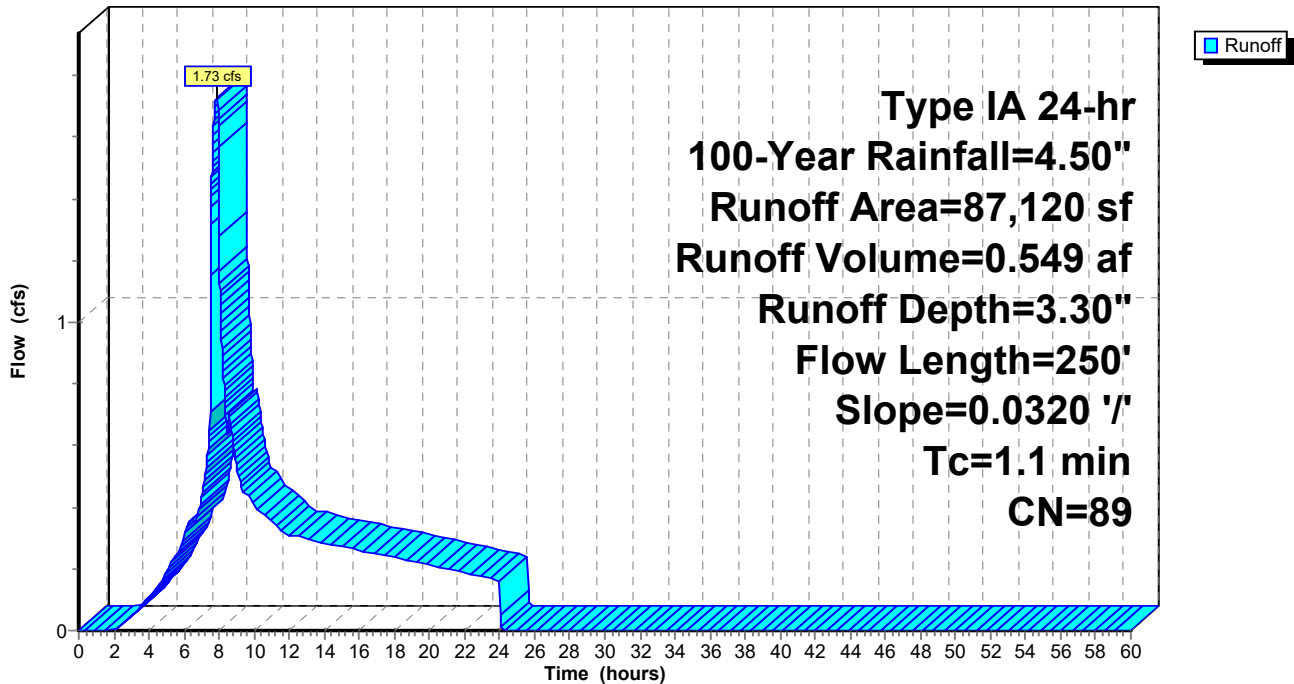
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr 100-Year Rainfall=4.50"

Area (sf)	CN	Description
43,615	80	>75% Grass cover, Good, HSG D
* 23,760	98	Max Lot Buildable
* 15,880	98	ROW
* 3,865	98	Existing (Lot 3)
87,120	89	Weighted Average
43,615		50.06% Pervious Area
43,505		49.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	250	0.0320	3.63		Shallow Concentrated Flow, Post-Conc. Flow Paved Kv= 20.3 fps

Subcatchment 2S: Post-Development

Hydrograph



Summary for Pond 1P: Tract B Detention Pond

Inflow Area = 2.000 ac, 49.94% Impervious, Inflow Depth = 3.30" for 100-Year event
 Inflow = 1.73 cfs @ 7.84 hrs, Volume= 0.549 af
 Outflow = 0.48 cfs @ 9.22 hrs, Volume= 0.505 af, Atten= 72%, Lag= 83.0 min
 Primary = 0.48 cfs @ 9.22 hrs, Volume= 0.505 af
 Routed to nonexistent node 2R

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Peak Elev= 203.63' @ 9.22 hrs Surf.Area= 2,680 sf Storage= 8,338 cf

Plug-Flow detention time= 576.6 min calculated for 0.505 af (92% of inflow)
 Center-of-Mass det. time= 522.0 min (1,248.4 - 726.5)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	12,225 cf	Detention Facility (Prismatic) Listed below (Recalc)

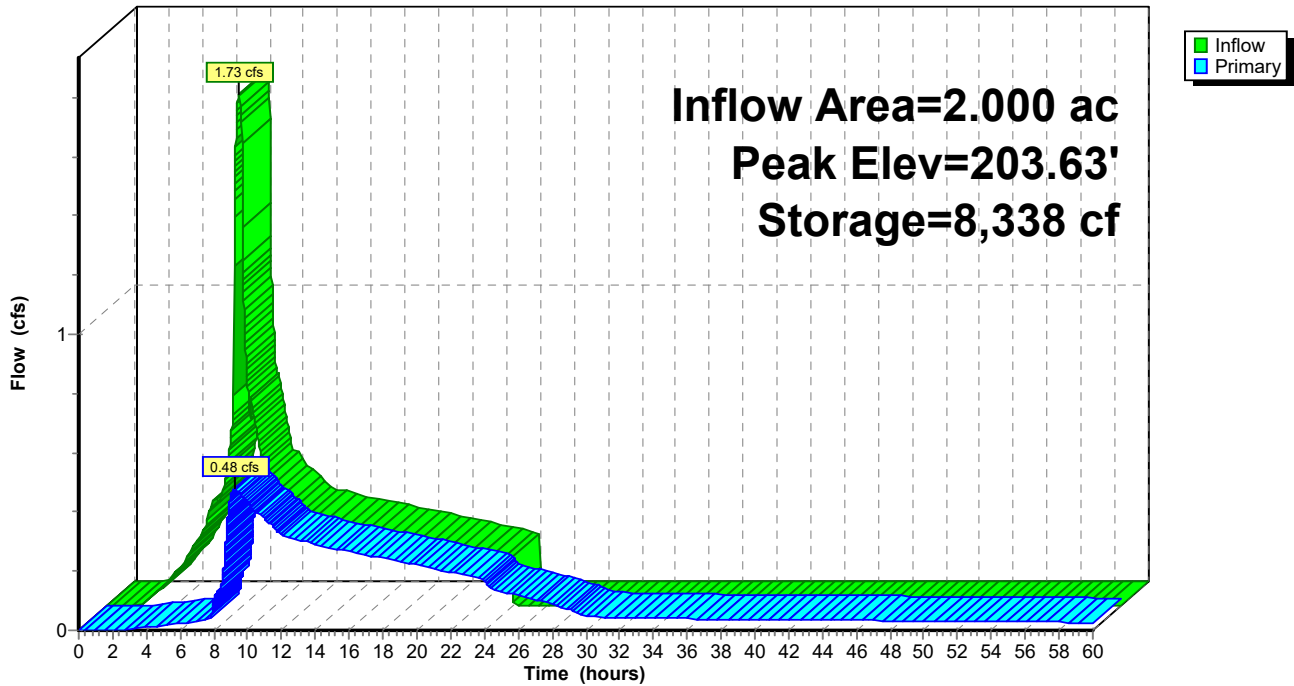
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	1,850	0	0
202.00	2,375	4,225	4,225
204.00	2,750	5,125	9,350
205.00	3,000	2,875	12,225

Device	Routing	Invert	Outlet Devices
#1	Primary	200.00'	12.0" Vert. 12" Private Storm Easement C= 0.600 Limited to weir flow at low heads
#2	Device 1	200.00'	1.0" Vert. 1" Weep Hole C= 0.600 Limited to weir flow at low heads
#3	Device 1	202.50'	2.0" Vert. 2" Outlet C= 0.600 Limited to weir flow at low heads
#4	Device 1	203.35'	12.0" Vert. 12" Outlet C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.48 cfs @ 9.22 hrs HW=203.63' (Free Discharge)
 ↑ **1=12" Private Storm Easement** (Passes 0.48 cfs of 6.69 cfs potential flow)
 ↑ **2=1" Weep Hole** (Orifice Controls 0.05 cfs @ 9.12 fps)
 ↑ **3=2" Outlet** (Orifice Controls 0.11 cfs @ 4.92 fps)
 ↑ **4=12" Outlet** (Orifice Controls 0.32 cfs @ 1.79 fps)

Pond 1P: Tract B Detention Pond

Hydrograph



OBC2001 Storm Prelim 072722

Type IA 24-hr trimmed to 4.00 hrs WQ 1" Rainfall=1.00"

Prepared by Reece & Associates, Inc

Printed 7/28/2022

HydroCAD® 10.20-2d s/n 04614 © 2021 HydroCAD Software Solutions LLC

Page 28

Time span=0.00-60.00 hrs, dt=0.01 hrs, 6001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre-Development

Runoff Area=87,120 sf 7.15% Impervious Runoff Depth=0.05"
Flow Length=298' Slope=0.0436 '/' Tc=28.3 min CN=77 Runoff=0.08 cfs 0.008 af

Subcatchment2S: Post-Development

Runoff Area=87,120 sf 49.94% Impervious Runoff Depth=0.28"
Flow Length=250' Slope=0.0320 '/' Tc=1.1 min CN=89 Runoff=0.26 cfs 0.047 af

Pond 1P: Tract B Detention Pond

Peak Elev=200.97' Storage=1,913 cf Inflow=0.26 cfs 0.047 af
Outflow=0.03 cfs 0.047 af

Total Runoff Area = 4.000 ac Runoff Volume = 0.055 af Average Runoff Depth = 0.17"
71.46% Pervious = 2.858 ac 28.54% Impervious = 1.142 ac

Summary for Subcatchment 1S: Pre-Development

Runoff = 0.08 cfs @ 4.12 hrs, Volume= 0.008 af, Depth= 0.05"

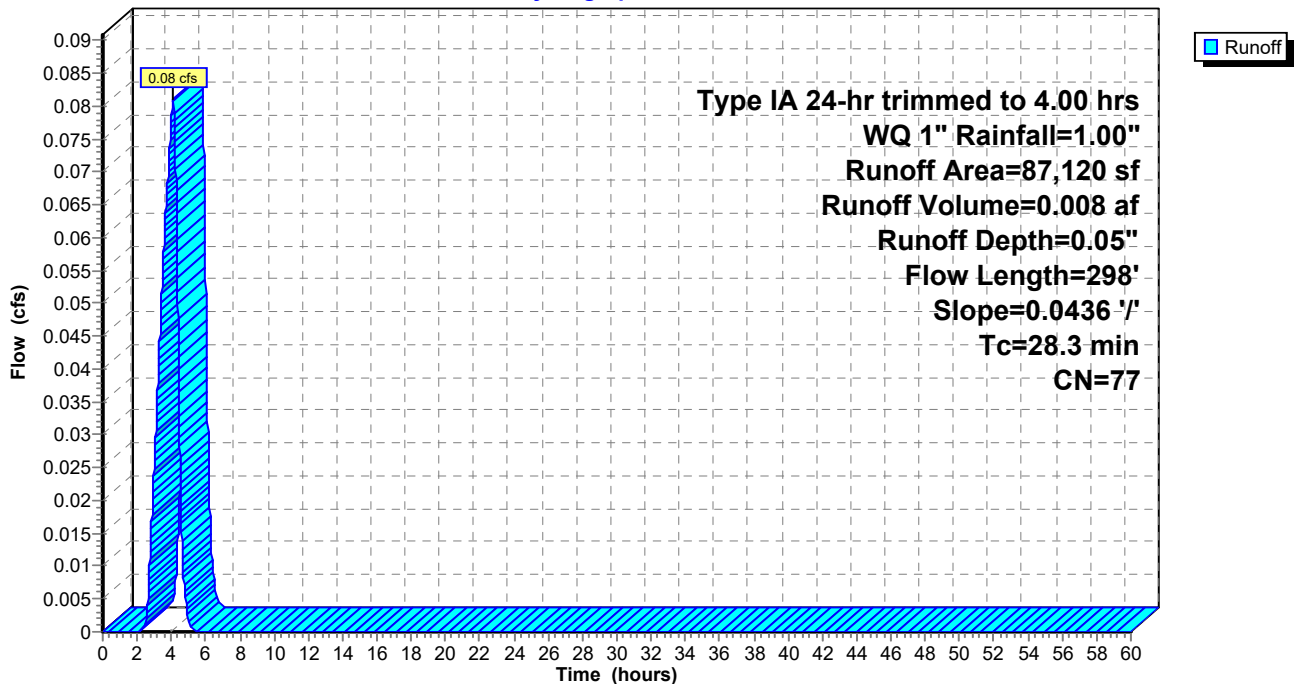
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr trimmed to 4.00 hrs WQ 1" Rainfall=1.00"

	Area (sf)	CN	Description
*	10,323	95	Gravel Driveway
*	1,181	98	Concrete Pad
*	5,050	98	Structures
	70,566	73	Brush, Good, HSG D
	87,120	77	Weighted Average
	80,889		92.85% Pervious Area
	6,231		7.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	298	0.0436	0.18		Sheet Flow, Pre-Sheet Grass: Dense n= 0.240 P2= 2.50"

Subcatchment 1S: Pre-Development

Hydrograph



Summary for Subcatchment 2S: Post-Development

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.26 cfs @ 3.99 hrs, Volume= 0.047 af, Depth= 0.28"
 Routed to Pond 1P : Tract B Detention Pond

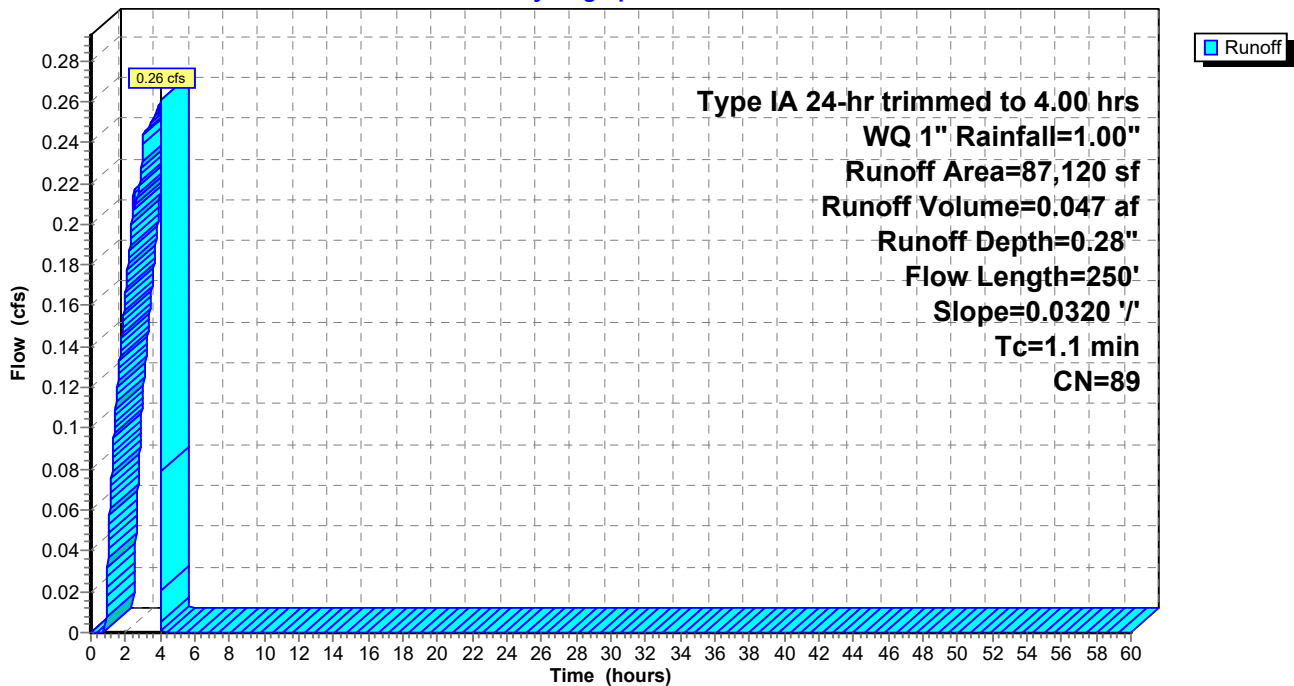
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Type IA 24-hr trimmed to 4.00 hrs WQ 1" Rainfall=1.00"

Area (sf)	CN	Description
43,615	80	>75% Grass cover, Good, HSG D
* 23,760	98	Max Lot Buildable
* 15,880	98	ROW
* 3,865	98	Existing (Lot 3)
87,120	89	Weighted Average
43,615		50.06% Pervious Area
43,505		49.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	250	0.0320	3.63		Shallow Concentrated Flow, Post-Conc. Flow Paved Kv= 20.3 fps

Subcatchment 2S: Post-Development

Hydrograph



Summary for Pond 1P: Tract B Detention Pond

Inflow Area = 2.000 ac, 49.94% Impervious, Inflow Depth = 0.28" for WQ 1" event
 Inflow = 0.26 cfs @ 3.99 hrs, Volume= 0.047 af
 Outflow = 0.03 cfs @ 4.03 hrs, Volume= 0.047 af, Atten= 90%, Lag= 2.5 min
 Primary = 0.03 cfs @ 4.03 hrs, Volume= 0.047 af
 Routed to nonexistent node 2R

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.01 hrs
 Peak Elev= 200.97' @ 4.03 hrs Surf.Area= 2,104 sf Storage= 1,913 cf

Plug-Flow detention time= 867.2 min calculated for 0.047 af (99% of inflow)
 Center-of-Mass det. time= 867.2 min (1,033.6 - 166.4)

Volume	Invert	Avail.Storage	Storage Description
#1	200.00'	12,225 cf	Detention Facility (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
200.00	1,850	0	0
202.00	2,375	4,225	4,225
204.00	2,750	5,125	9,350
205.00	3,000	2,875	12,225

Device	Routing	Invert	Outlet Devices
#1	Primary	200.00'	12.0" Vert. 12" Private Storm Easement C= 0.600 Limited to weir flow at low heads
#2	Device 1	200.00'	1.0" Vert. 1" Weep Hole C= 0.600 Limited to weir flow at low heads
#3	Device 1	202.50'	2.0" Vert. 2" Outlet C= 0.600 Limited to weir flow at low heads
#4	Device 1	203.35'	12.0" Vert. 12" Outlet C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.03 cfs @ 4.03 hrs HW=200.97' (Free Discharge)
 ↑ **1=12" Private Storm Easement** (Passes 0.03 cfs of 2.60 cfs potential flow)
 ↑ **2=1" Weep Hole** (Orifice Controls 0.03 cfs @ 4.63 fps)
 ↑ **3=2" Outlet** (Controls 0.00 cfs)
 ↑ **4=12" Outlet** (Controls 0.00 cfs)

Pond 1P: Tract B Detention Pond

Hydrograph

