

B. Jack

7642

**PRELIMINARY DRAINAGE ANALYSIS
FOR**

**Basinger Partition
Keizer, Oregon**

**Owner:
Kathleen R. Basinger Living Trust
7624 Kayla Shae Street NE
Keizer, Oregon 97303**

April 24, 2024



Renew date: 6.30.2025



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INTRODUCTION

The Basinger Partition project is a proposed single-family home development located at 7624 Kayla Shae St NE. The parcel of land to be developed includes tax lot 802 and 805 of Marion County Assessor's Map 06 3W 23DD and is approximately 0.81-acres in size. A vicinity map is included in Appendix A and an aerial image is shown below.

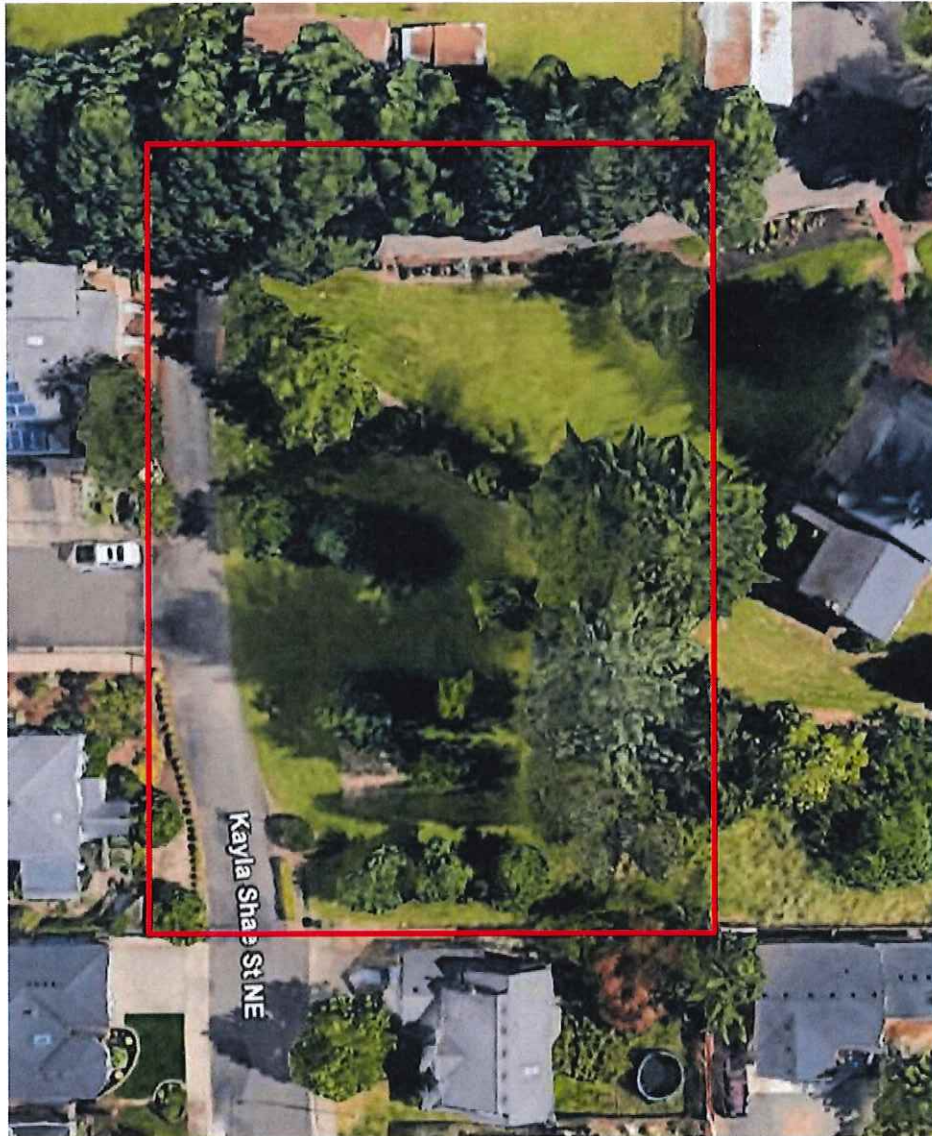


Figure 1. Project Site

Green Stormwater Infrastructure (GSI) to the Maximum Extent Feasible (MEF) will be used for the newly developed areas per City of Keizer Design Standards. All facilities will be constructed to meet the City of Keizer standards.

EXISTING CONDITIONS

The 0.81-acre project site is rectangular in shape. Surface conditions consist of short grass, a variety of trees spread across the property, and an existing driveway. There are no identified wetlands or sensitive areas located on the property. The existing site slopes from the northwest corner to the southeast, with a relief of 9 feet. The abutting properties are zoned single-family residential and urban transition. Offsite runoff is not expected due to the existing drainage system serving the surrounding properties. The soil map from the NRCS Web Soil Survey in Appendix B shows that this location is comprised entirely of Woodburn silt loam which is classified as hydrologic soil group C. As directed by the City of Keizer design standards, for this soil group, predeveloped runoff rates are evaluated with a curve number of 72.

For this preliminary report, the infiltration rate is estimated based on testing performed for the nearby Bohlander Meadows Subdivision project. These tests were conducted using the open pit falling head procedure and found an infiltration rate of 12 in/hr. The design infiltration rate will apply a safety factor of 2 to the tested average and therefore be treated as 6 in/hr. Infiltration test results are contained in Appendix C.

DEVELOPED CONDITIONS

This single-family home project adds hard surface from the roof and driveway that will require mitigation. Until the design of the house and driveway are completed and a more accurate value is available, the impervious area is approximated at 2,700 sq-ft. Driveway runoff is collected in a slot drain and roof runoff is collected in gutters before flowing to a rain garden.

This project may require public improvement by extending Heatherwood Ave NE and Kayla Shae St NE, adding approximately 10,000 sq-ft of impervious surface. If this improvement is required, runoff from the new roadway will collect in the gutter and enter an infiltration planter. Runoff from these impervious surfaces is calculated using a curve number of 98.

EXPLANATION OF DESIGN

The proposed facilities will provide water quality treatment by allowing for the removal of pollutants through filtration, adsorption onto surrounding vegetation, sedimentation, and biological uptake. All facilities utilize 30% void ratio drain rock and a maximum of side slope of 3:1.

Runoff from the new roof and driveway is routed to a rain garden in the southeast corner of the property. Vertically, the proposed infiltration rain garden is designed with the top of the facility 1.5 feet above the growing media, 12 inches of growing media, 3 inches of separation rock, and 1 foot of drain rock. For storms up to and including the 100-year event all runoff infiltrates the growing media and then the native soil. For storms larger than the 100-year event a type 3 catch basin with its rim set 0.9 feet above the growing media provides an emergency overflow. If the rain garden capacity is exceeded, the overflow structure allows stormwater to flow out into the public conveyance system. This is the only outlet from the rain garden and should not be used during any design event. This analysis considers a 460 sq-ft rain garden for water quality and quantity requirements.

Runoff developed on the northern portion of Kayla Shae St drains to an infiltration planter strip set between the sidewalk and roadway. Vertically, the proposed planter strip is designed with the growing media 0.4 feet below the gutter flowline, 12 inches of growing media, 3 inches of separation rock, and 4 feet of drain rock. Since the elevation of the planter strip is based on the roadway elevation, which is not finalized, the design assumes the top of the growing media is at 164.00 feet. The facility is formed by

standard planter walls set on a 6-inch bench of native soil. These soil benches cause a reduction in the surface area of the drain rock compared to the growing media, which is reflected in the analysis. For storm events larger than the water quality a 24-inch beehive inlet with its rim set 4 inches above the growing media will allow stormwater to bypass the growing media, enter the drain rock layer, and reside there until it infiltrates the native soil. Emergency overflow is provided by a 10-inch pipe set in the side of the beehive inlet structure so that the pipe invert is directly above the drain rock. If the drain rock capacity is exceeded, stormwater entering the beehive inlet will begin flowing into the public conveyance system. This is the only outlet from the planter strip and should not be used during any design event. This analysis considers a planter strip with 175 sq-ft of surface area for water quality and quantity requirements.

Runoff developed on the southern portion of Kayla Shae St drains to an infiltration planter box set behind the sidewalk. Vertically, the proposed planter box is designed with the growing media 2 feet below the ground surface, 12 inches of growing media, 3 inches of separation rock, and 4 feet of drain rock. The facility is formed by retaining walls. For storm events larger than the water quality a 24-inch beehive inlet with its rim set 4 inches above the growing media will allow stormwater to bypass the growing media, enter the drain rock layer, and reside there while infiltrating the native soil. Similar to the planter strip, emergency overflow is provided by a 10-inch pipe set in the side of the beehive inlet structure so that the pipe invert is directly above the drain rock. This is the only outlet from the planter box and should not be used during any design event. This analysis considers a planter box with 300 sq-ft of surface area for water quality and quantity requirements.

STORMWATER ANALYSIS

Stormwater analysis is conducted using HydroCAD 10.20 and, based on the region, the storm type was selected as Type 1A 24-hr. For projects with a design infiltration rate greater than 2 in/hr, the City of Keizer requires that the facility treat the water quality storm and retain the 100-yr storm event. The 24-hr rainfall depths for the 100-yr and water quality storms are 4.4 and 1.38 inches, respectively.

In the analysis of the rain garden, the first node models the storage space above the growing media and allows outflow through the growing media and emergency overflow catch basin. Outflow from the growing media is then routed to the second node. This node models the drain rock below the facility and allows outflow into the native soil based on the infiltration rate.

In the analysis of both the planter strip and box, the first node models the storage space above the growing media and allows outflow through the growing media and beehive inlet. Flow from both outlets is then routed to the second node. This node models the drain rock below the facility and allows outflow into the native soil based on the infiltration rate.

WATER QUALITY

Private

In this analysis the primary outflow shows water passing through the growing medium and the secondary outflow represents water passing through the emergency overflow. For this storm event the water may not exceed 4 inches above the growing media, which is at an elevation of 161.50 ft. As directed by the City of Keizer the infiltration rate through the growing medium was modeled at 2 in/hr.

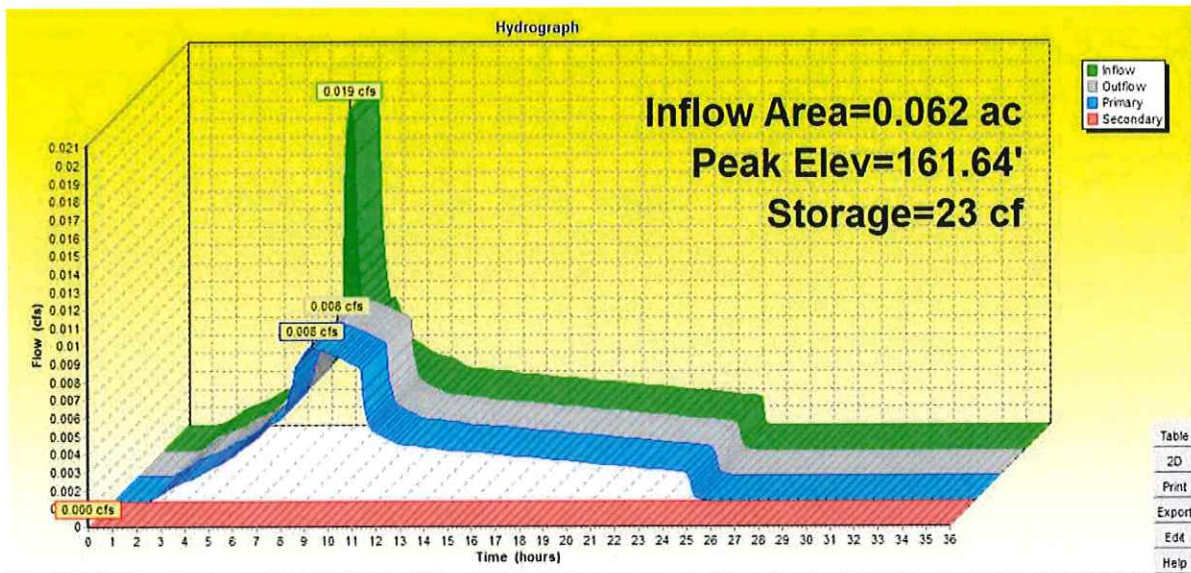


Figure 2. Private Water Quality

This graph shows the maximum water depth was 0.14 feet above the soil and all stormwater filtered through the growing media. The report associated with this hydrograph can be found in Appendix D.

Public

Similar to the previous analysis, the primary outflow shows flow through the growing media and the secondary outflow shows flow through the beehive inlet. During this event the water surface level must not exceed 4 inches in depth and the infiltration rate through the growing medium is modeled at 2 in/hr. The top of the growing media in the planter strip and box are 164.00 ft and 163.50 ft, respectively.

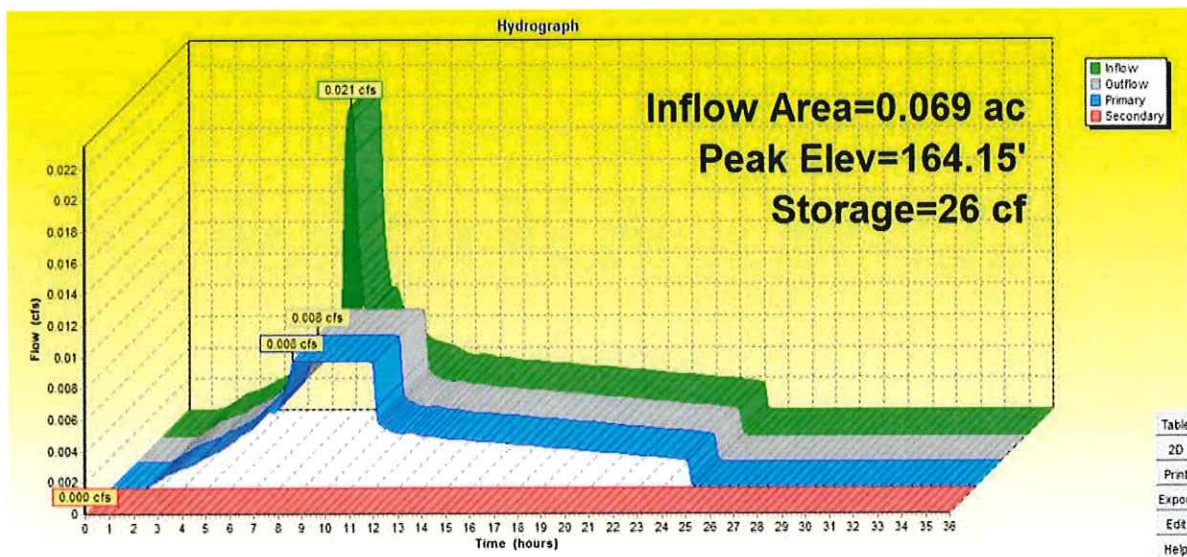


Figure 3. Public Planter Strip Water Quality

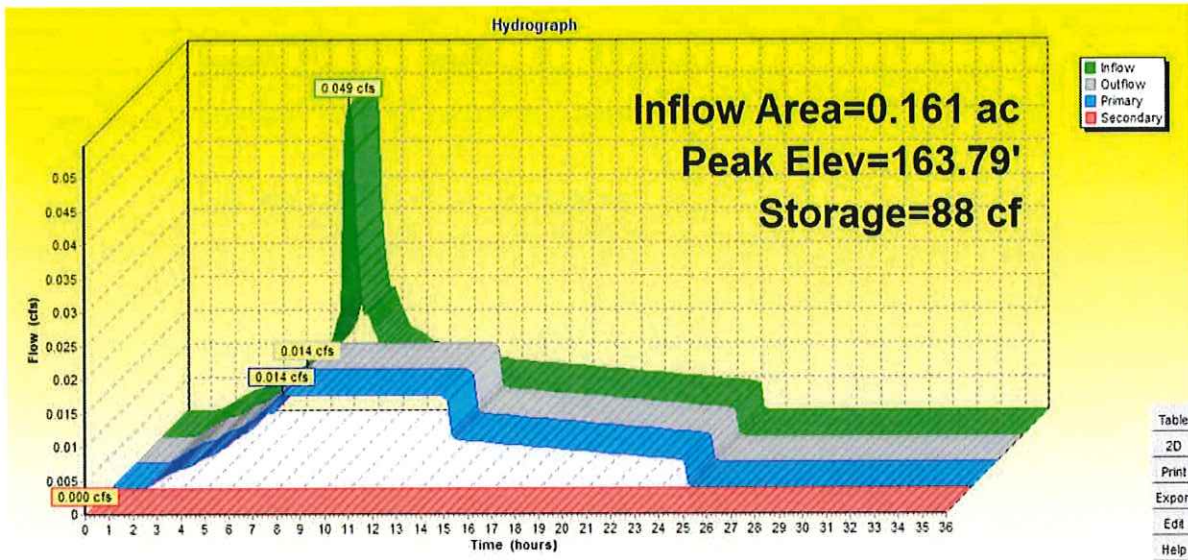


Figure 4. Public Planter Box Water Quality

Figures 3 and 4 show that stormwater in the public infiltration planters pools to a maximum depth of 0.30 feet. More information on these hydrographs can be found in Appendix D.

WATER QUANTITY

Private

The private rain garden manages stormwater quantity by storing it above the growing media while it infiltrates. This system has a flat bottom elevation of 161.50 ft and an overflow structure with its rim set at 162.40 ft. In this hydrograph, primary outflow shows water passing through the growing media and the secondary outflow represents water entering the public conveyance system.

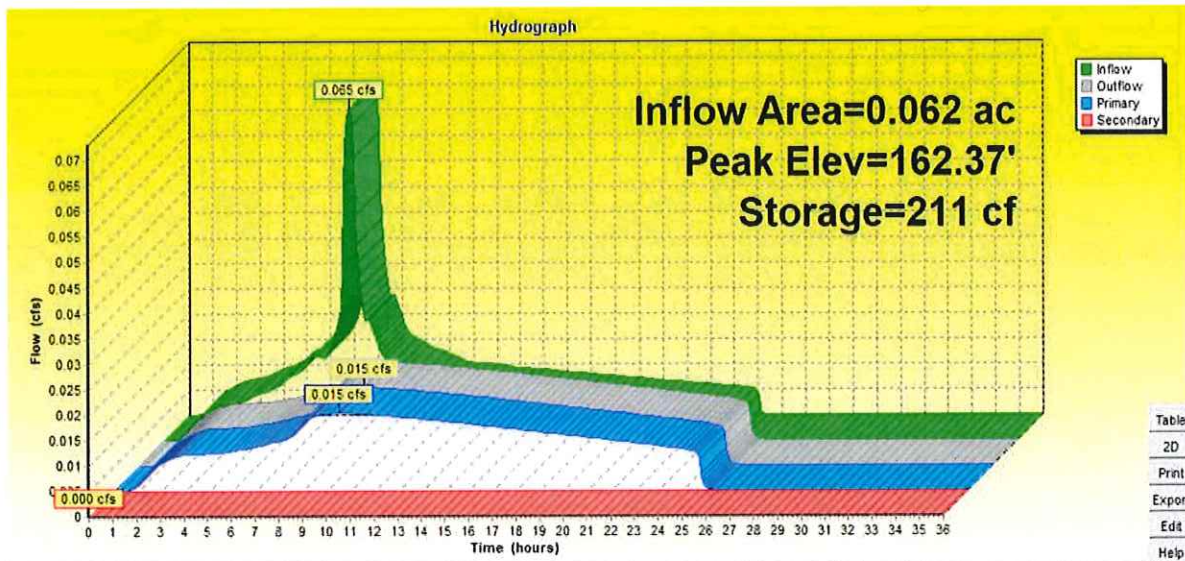


Figure 5. Private Rain Garden 100-Year Storm

This graph shows that during the 100-year event, all stormwater is retained, and the water surface level peaked 0.87 feet above the growing media. More information on this hydrograph can be found in Appendix E.

Public

In the public infiltration planters, the rock gallery is intended to retain and infiltrate all runoff up to and including the 100-year event. In these hydrographs, infiltration is shown as discarded outflow and emergency overflow is shown as secondary outflow. The top of the rock gallery is at 162.75 feet for the planter strip and 162.25 feet for the planter box.

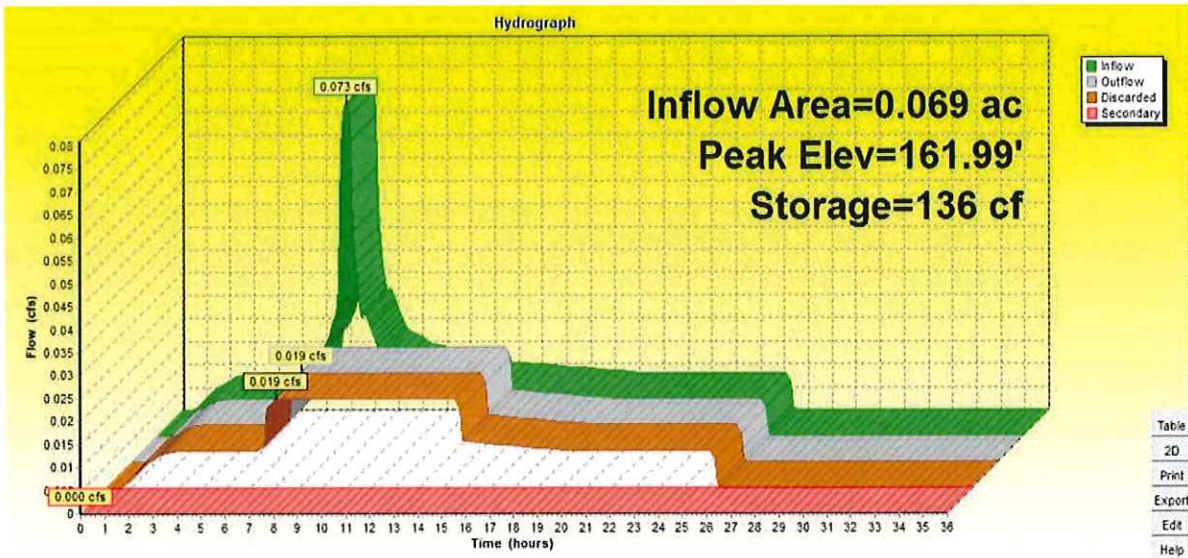


Figure 6. Public Planter Strip 100-Year Storm

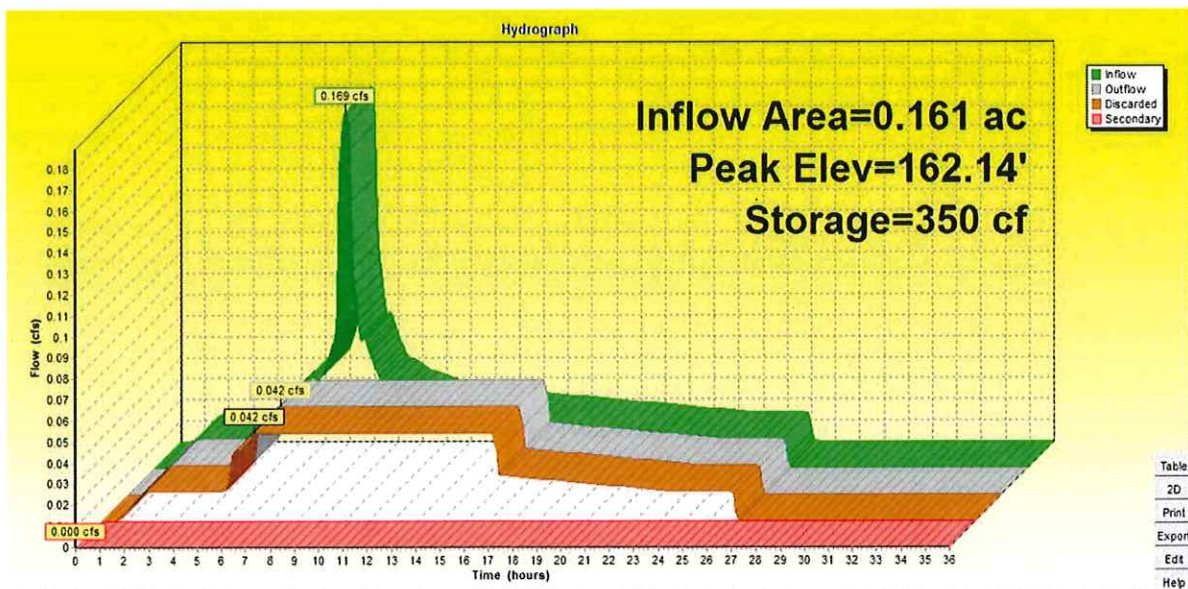


Figure 7. Public Planter Box 100-Year Storm

Figures 6 and 7 show that during the largest storm event, these facilities have the required storage to retain and the surface area to infiltrate runoff without any outflow to the public conveyance system. Detailed reports for these hydrographs can be found in Appendix E.

OPERATIONS AND MAINTENANCE

In this design, private stormwater is treated and infiltrated via a rain garden which will be the property owner's responsibility to maintain. The City of Salem's rain garden maintenance form is included in Appendix F. The infiltration planter strip and box treating runoff from a public roadway will be the City of Keizer's responsibility to maintain.

DESIGN SUMMARY

Private

This analysis shows that a rain garden with a surface area of 460 sq-ft and the design listed in Table 1, is sufficient to treat, retain, and infiltrate all private stormwater.

Table 1. Rain Garden Design Summary

Location	Elevation (ft)
Top of Facility	163.00
Rim of Catch Basin	162.40
Top of Growing Media	161.50
Top of Separation Rock	160.50
Top of Drain Rock	160.25
Bottom of Drain Rock	159.25

Public

This analysis shows that infiltration planters with the surface areas listed in Table 2 and designs noted in Tables 3 and 4 are sufficient to manage all public stormwater.

Table 2. Infiltration Planter Sizes

Infiltration Planter	Surface Area (sq-ft)
Strip	175
Box	300

Table 3. Planter Strip Design Summary

Location	Elevation (ft)
Top of Facility	164.75
Rim of Beehive Inlet	164.33
Top of Growing Media	164.00
Top of Separation Rock	163.00
Top of Drain Rock	162.75
Bottom of Drain Rock	158.75

Table 4. Planter Box Design Summary

Location	Elevation (ft)
Top of Facility	164.50
Rim of Beehive Inlet	163.83
Top of Growing Media	163.50
Top of Separation Rock	162.50
Top of Drain Rock	162.25
Bottom of Drain Rock	158.25

CONCLUSION

This facility should be adequate to meet both water quality and quantity design requirements as shown. If there are any questions, please contact Brenden Jack at BJack@mtengineering.net or Natalie Janney at NJanney@mtengineering.net.

APPENDIX A: MAPS

06 3W 23DD
KEIZER

06 3W 23DD
KEIZER



MARION COUNTY, OREGON
SE1/4 SE1/4 SEC23 T6S R3W W.M.
SCALE 1" = 100'

LEGEND

- LINE TYPES**
--- Taxlot Boundary
--- Road Right-of-Way
--- Railroad Right-of-Way
--- Private Road ROW
--- Subdivision Plat Boundary
--- Waterline - Taxlot Boundary
--- Waterline - Non Brady
--- Historical Boundary
--- Easement
--- Railroad Centerline
--- Taxlot Line
--- Map Boundary
--- Waterline - Non Brady

- CORNER TYPES**
+ 1/16TH Section Cor.
+ 1/4 Section Cor.
+ 1/2 Section Cor.
+ 3/4 Section Cor.
+ Section Corner
+ 21' 22'

NUMBERS
Tax Code Number
00 00
00 00
00 00

All acres listed are Net Acres, excluding any portions of the taxlot within public ROWs

NOTES
Tick Marks: A tick mark in the road indicates that the labeled dimension extends into the public ROW

CANCELLED NUMBERS

100	201
202	301
401	500
600	700
800	900
1000	1100
1200	1300
1400	1500
1600	1700
1800	1900
2000	2100
2200	2300
2400	2500
2600	2700
2800	2900
3000	3100
3200	3300
3400	3500
3600	3700
3800	3900
4000	4100
4200	4300
4400	4500
4600	4700
4800	4900
5000	5100
5200	5300
5400	5500
5600	5700
5800	5900
6000	6100
6200	6300
6400	6500
6600	6700
6800	6900
7000	7100
7200	7300
7400	7500
7600	7700
7800	7900
8000	8100
8200	8300
8400	8500
8600	8700
8800	8900
9000	9100
9200	9300
9400	9500
9600	9700
9800	9900

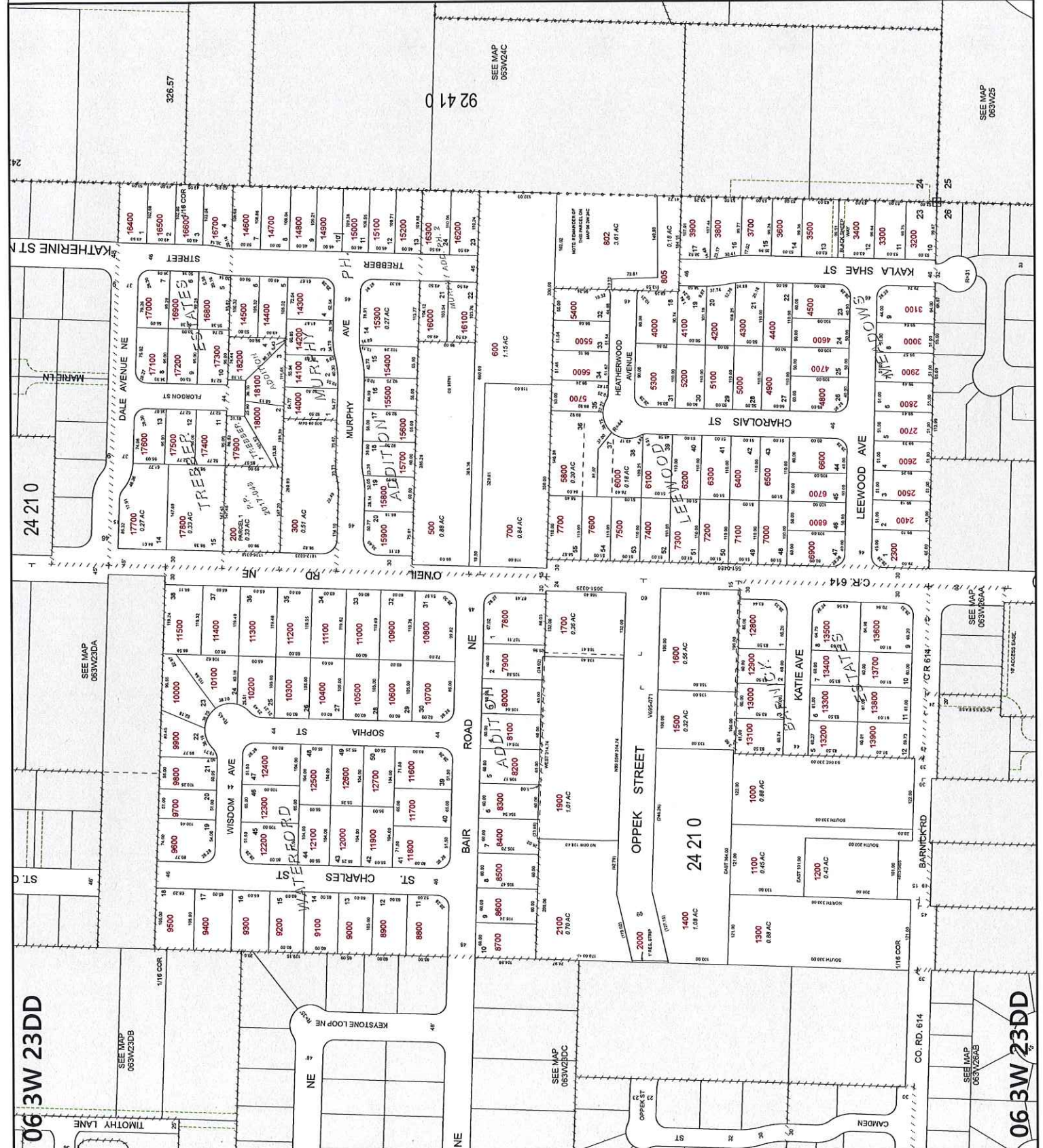
DISCLAIMER: THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY



FOR ADDITIONAL MAPS VISIT OUR WEBSITE AT www.co.marion.or.us

PLOT DATE: 10/16/2020

06 3W 23DD
KEIZER



92 41 0
SEE MAP 063W24C

SEE MAP 063W25

SEE MAP 063W23DA

SEE MAP 063W23DB

SEE MAP 063W23DC

SEE MAP 063W23DA

06 3W 23DD
KEIZER

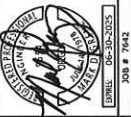
ENGINEERING SERVICES, INC.
 1585 83th St. S.E. SALEM, OR 97306
 PH. (503) 343-4327 FAX (503) 343-1349
 www.mhfi.com
MULTI/TECH

EXISTING CONDITIONS
PLAN

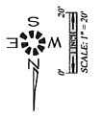
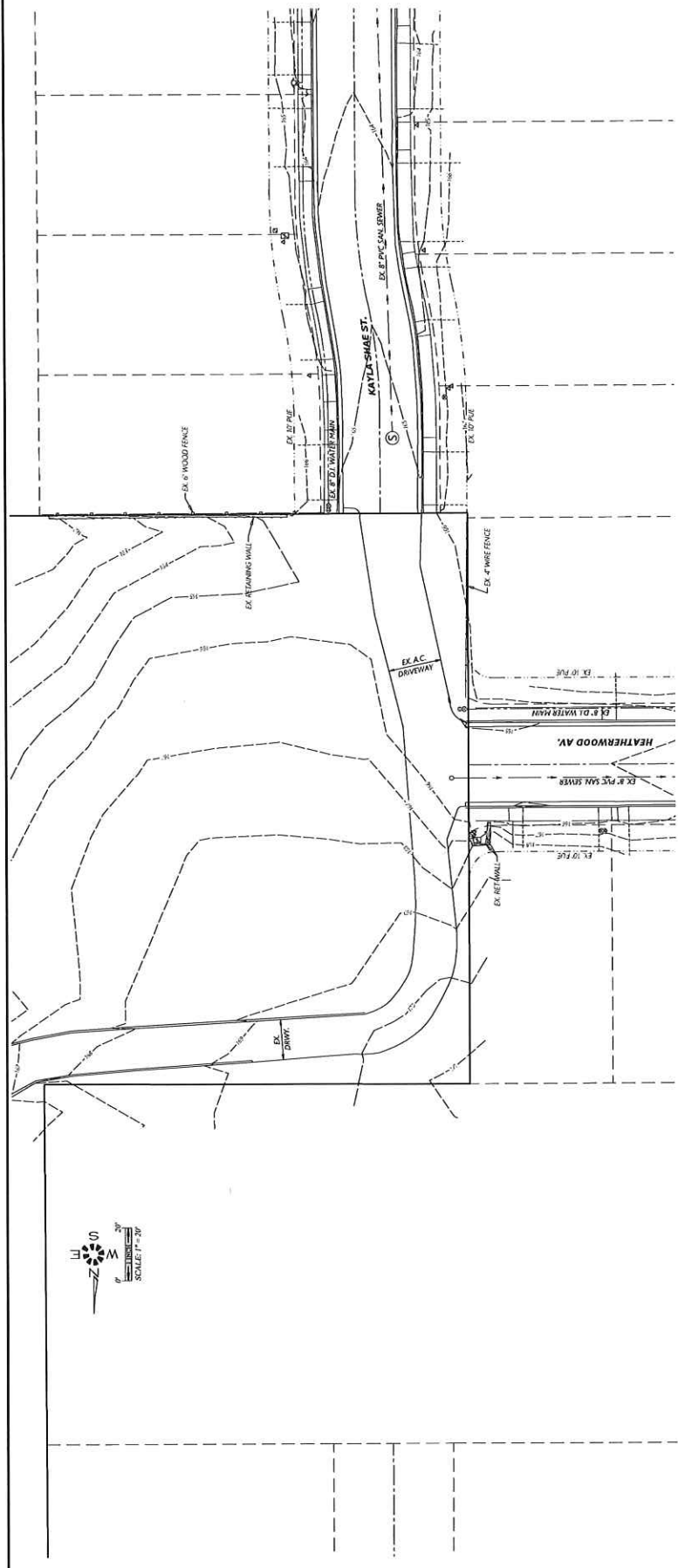
BASINGER
PARTITION PLAN

NO CHANGES, MODIFICATIONS
 OR REVISIONS TO BE
 MADE TO THESE DRAWINGS
 WITHOUT WRITTEN
 AUTHORIZATION FROM THE
 DESIGN ENGINEER.
 DIMENSIONS & NOTES TAKE
 PRECEDENCE OVER
 GRAPHICAL REPRESENTATION.

As-Built: _____
 Scale: AS SHOWN
 Issue Date: 4/23/24
 Checked: M.G.J.
 Drawn: D.G.S.
 Design: M.D.G.



102
 JOB # 7442
 DTHL 02-23-2025



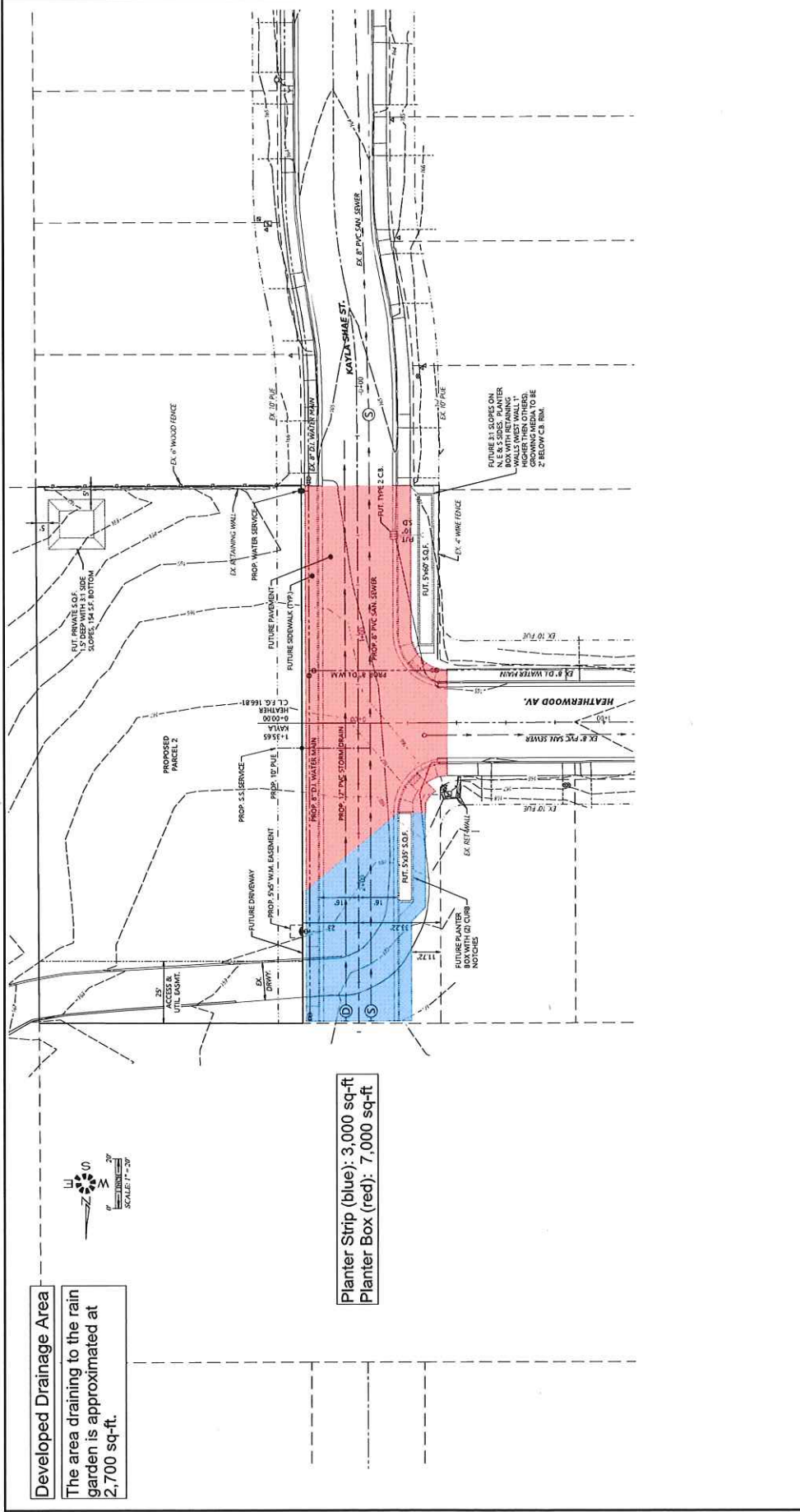
Drawing is NOT to scale

UTILITIES & FUTURE STREET PLAN

BASINGER PARTITION PLAN

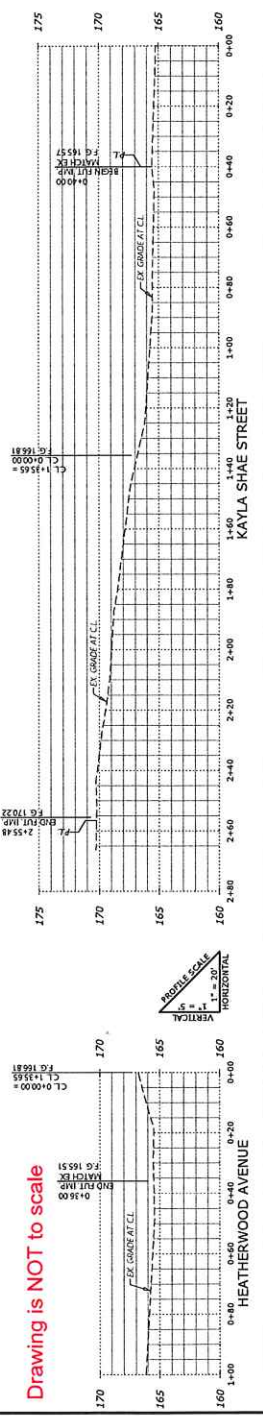
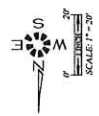
NO CHANGES, MODIFICATIONS OR REVISIONS TO BE MADE TO THESE DRAWINGS. DRAWN: M.D.G. CHECKED: M.D.G. AUTHORIZATION FROM THE DESIGN ENGINEER. DIMENSIONS & NOTES TAKE PRECEDENCE OVER GRAPHICAL REPRESENTATION.

As-Built: ---
Draft: AS SHOWN
Issue Date: 4/23/24
Checked: M.D.G.
Drawn: M.D.G.
Design: M.D.G.
NO CHANGES, MODIFICATIONS OR REVISIONS TO BE MADE TO THESE DRAWINGS.

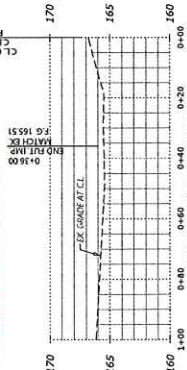


Developed Drainage Area
 The area draining to the rain garden is approximated at 2,700 sq-ft.

Planter Strip (blue): 3,000 sq-ft
Planter Box (red): 7,000 sq-ft



Drawing is NOT to scale

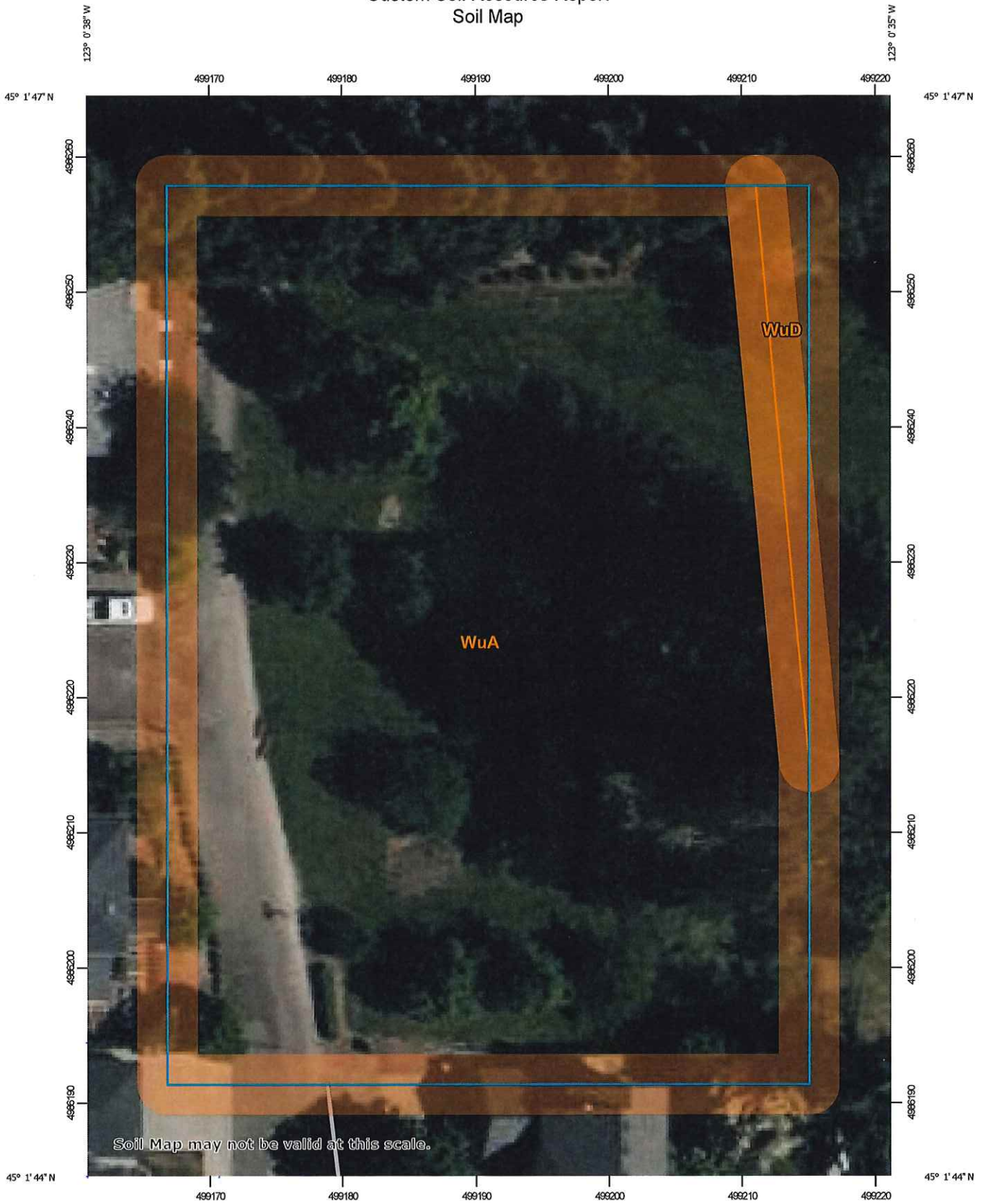


APPENDIX B: NRCS WEB SOIL SURVEY

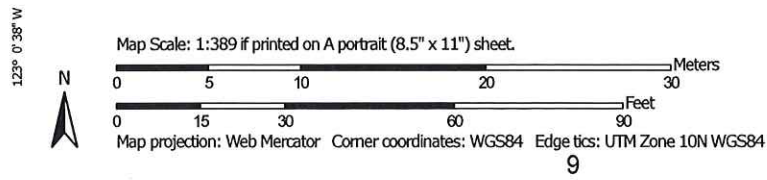
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.
































Custom Soil Resource Report
Soil Map



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
-  Streams and Canals
- Water Features**
-  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: Marion County Area, Oregon
 Survey Area Data: Version 21, Sep 8, 2023

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

Date(s) aerial images were photographed: May 17, 2023—Jun 3, 2023

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
WuA	Woodburn silt loam, 0 to 3 percent slopes	0.8	97.4%
WuD	Woodburn silt loam, 12 to 20 percent slopes	0.0	2.6%
Totals for Area of Interest		0.8	100.0%

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

Custom Soil Resource Report

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.

Marion County Area, Oregon

WuA—Woodburn silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 24s3
Elevation: 150 to 350 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 200 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodburn and similar soils: 85 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium and mixed mineralogy loess

Typical profile

H1 - 0 to 17 inches: silt loam
H2 - 17 to 32 inches: silty clay loam
H3 - 32 to 68 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: R002XC008OR - Valley Terrace Group
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Aquolls, somewhat poorly drained
Percent of map unit: 1 percent

Custom Soil Resource Report

Landform: Terraces
Hydric soil rating: Yes

WuD—Woodburn silt loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: 24s5
Elevation: 150 to 350 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 200 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Woodburn and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium and mixed mineralogy loess

Typical profile

H1 - 0 to 17 inches: silt loam
H2 - 17 to 32 inches: silty clay loam
H3 - 32 to 68 inches: silt loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R002XC008OR - Valley Terrace Group
Forage suitability group: Moderately Well Drained >15% Slopes (G002XY003OR)
Other vegetative classification: Moderately Well Drained >15% Slopes (G002XY003OR)

Custom Soil Resource Report

Hydric soil rating: No

Minor Components

Aquolls, poorly drained

Percent of map unit: 5 percent

Landform: Terraces

Hydric soil rating: Yes

APPENDIX C: INFILTRATION TEST RESULTS



Bolander Site

Infiltration Test

Test No. 1

March 3rd, 2024

Site Soils are a Silty Clay Loam over Silty Loam

Time (min)	Time Difference (min)	Water Level (feet)	Infiltration (feet)	Infiltration (Inches)	Infiltration Rate In/Min	Infiltration Rate In/hr	Cumulative Infiltration (inches)
0		1.4					
4	4	1.48	0.08	0.96	0.24	14.4	0.96
8	4	1.56	0.08	0.96	0.24	14.4	1.92
12	4	1.63	0.07	0.84	0.21	12.6	2.76
16	4	1.7	0.07	0.84	0.21	12.6	3.6
20	4	1.77	0.07	0.84	0.21	12.6	4.44
30	10	1.95	0.18	2.16	0.216	12.96	6.6
40	10	2.1	0.15	1.8	0.18	10.8	8.4
50	10	2.25	0.15	1.8	0.18	10.8	10.2
60	10	2.4	0.15	1.8	0.18	10.8	12
70	10						
80	10		0	0	0	0	0
90	10		0	0	0	0	0
100	10		0	0	0	0	0
120	20		0	0	0	0	0

Average Rate 12

Design Rate 12 in/hr

24 Hour Design Rate 288 in



Bolander Site

Infiltration Test

Test No. 2

March 3rd, 2024

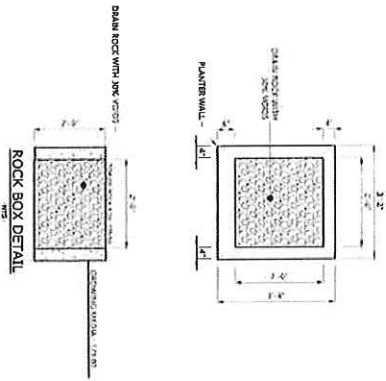
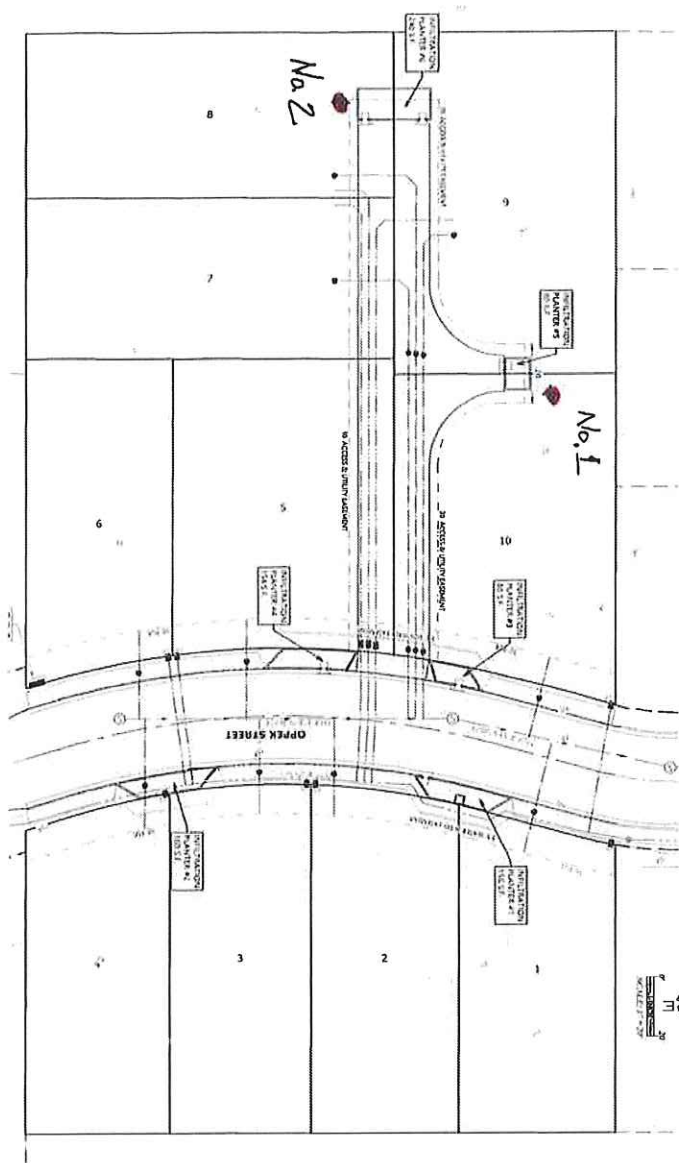
Site Soils are a Silty Clay Loam over Silty Loam

Time (min)	Time Difference (min)	Water Level (feet)	Infiltration (feet)	Infiltration (Inches)	Infiltration Rate In/Min	Infiltration Rate In/hr	Cumulative Infiltration (Inches)
0		1.55					
4	4	1.63	0.08	0.96	0.24	14.4	0.96
8	4	1.72	0.09	1.08	0.27	16.2	2.04
12	4	1.8	0.08	0.96	0.24	14.4	3
16	4	1.87	0.07	0.84	0.21	12.6	3.84
20	4	1.94	0.07	0.84	0.21	12.6	4.68
30	10	2.1	0.16	1.92	0.192	11.52	6.6
40	10	2.26	0.16	1.92	0.192	11.52	8.52
50	10	2.42	0.16	1.92	0.192	11.52	10.44
60	10	2.58	0.16	1.92	0.192	11.52	12.36
70	10						
80	10		0	0	0	0	0
90	10		0	0	0	0	0
100	10		0	0	0	0	0
120	20		0	0	0	0	0

Average Rate 12.36

Design Rate 12 in/hr

24 Hour Design Rate 288 in



SEE SHEET 301 FOR
PLANTER DETAILS
SEE SHEET 302 FOR
STORM DETAIL
SEE SHEET 303 FOR
PLANTER DETAILS

301

DATE: 1/24/24

DESIGNER: H.D.G.

DRAWN: J.K.O.

CHECKED: J.J.G.

ISSUE DATE: 1/24/24

SCALE: AS SHOWN

AS-BUILT: ...

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DIMENSIONS & NOTES TAKE
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GRAPHICAL REPRESENTATION

BOHLANDER MEADOWS

STORM DRAIN PLAN

MULTI/TECH

ENGINEERING SERVICES, INC.

1125 17th St. S.W. Salem, OR 97302

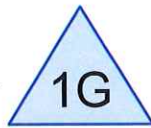
PH: (503) 383-0227 FAX: (503) 384-1260

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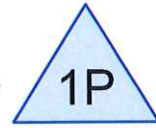
APPENDIX D: WATER QUALITY HYDROGRAPHS



Roof & Driveway



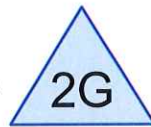
Growing Media



Drain Rock



North Side Road and Sidewalk



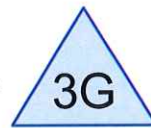
Growing Media



Drain Rock



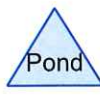
South Side Road and Sidewalk



Growing Media



Drain Rock



Routing Diagram for 7642 Preliminary Drainage HydroCAD
Prepared by Multi/Tech Engineering Service, Printed 4/24/2024
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7642 Preliminary Drainage HydroCAD

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Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	Water Quality	Type IA 24-hr		Default	24.00	1	1.38	2

7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Page 3

Summary for Subcatchment 1: Roof & Driveway

Runoff = 0.019 cfs @ 7.87 hrs, Volume= 0.006 af, Depth= 1.16"
 Routed to Pond 1G : Growing Media

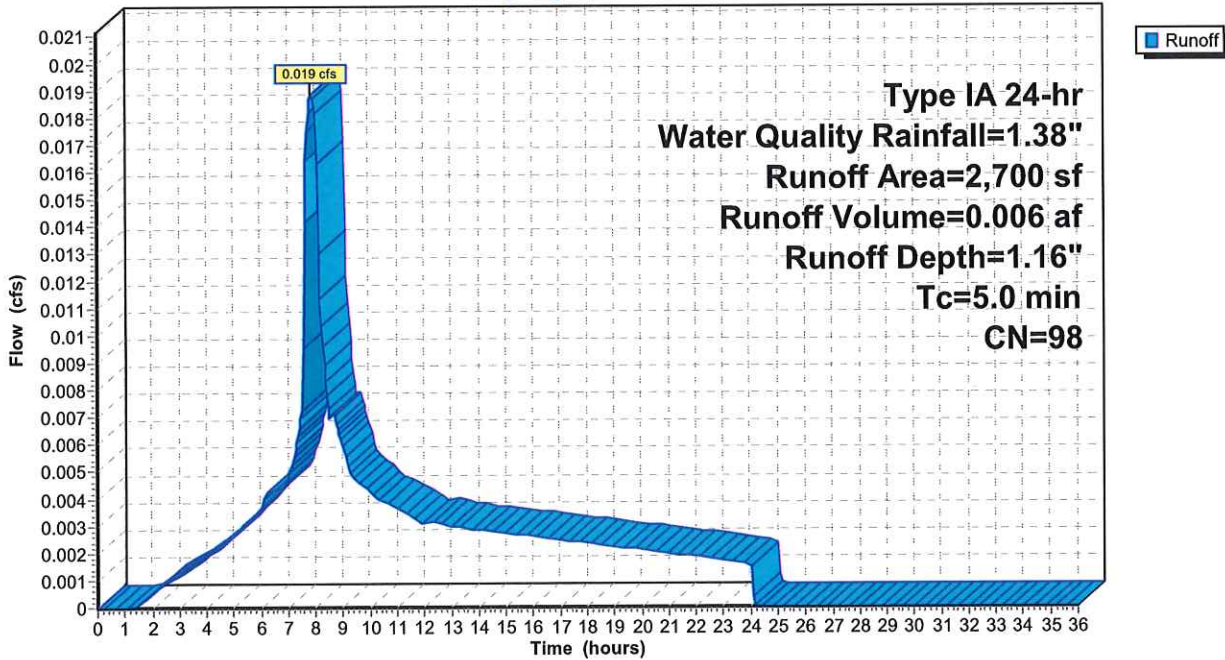
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
2,700	98	Paved parking, HSG C
2,700		100.00% Impervious Area

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

Subcatchment 1: Roof & Driveway

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Pond 1G: Growing Media

Inflow Area = 0.062 ac, 100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
 Inflow = 0.019 cfs @ 7.87 hrs, Volume= 0.006 af
 Outflow = 0.008 cfs @ 8.34 hrs, Volume= 0.006 af, Atten= 55%, Lag= 28.1 min
 Primary = 0.008 cfs @ 8.34 hrs, Volume= 0.006 af
 Routed to Pond 1P : Drain Rock
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 161.64' @ 8.34 hrs Surf.Area= 182 sf Storage= 23 cf

Plug-Flow detention time= 15.3 min calculated for 0.006 af (100% of inflow)
 Center-of-Mass det. time= 15.3 min (710.7 - 695.4)

Volume	Invert	Avail.Storage	Storage Description
#1	161.50'	461 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
161.50	154	0	0
163.00	460	461	461

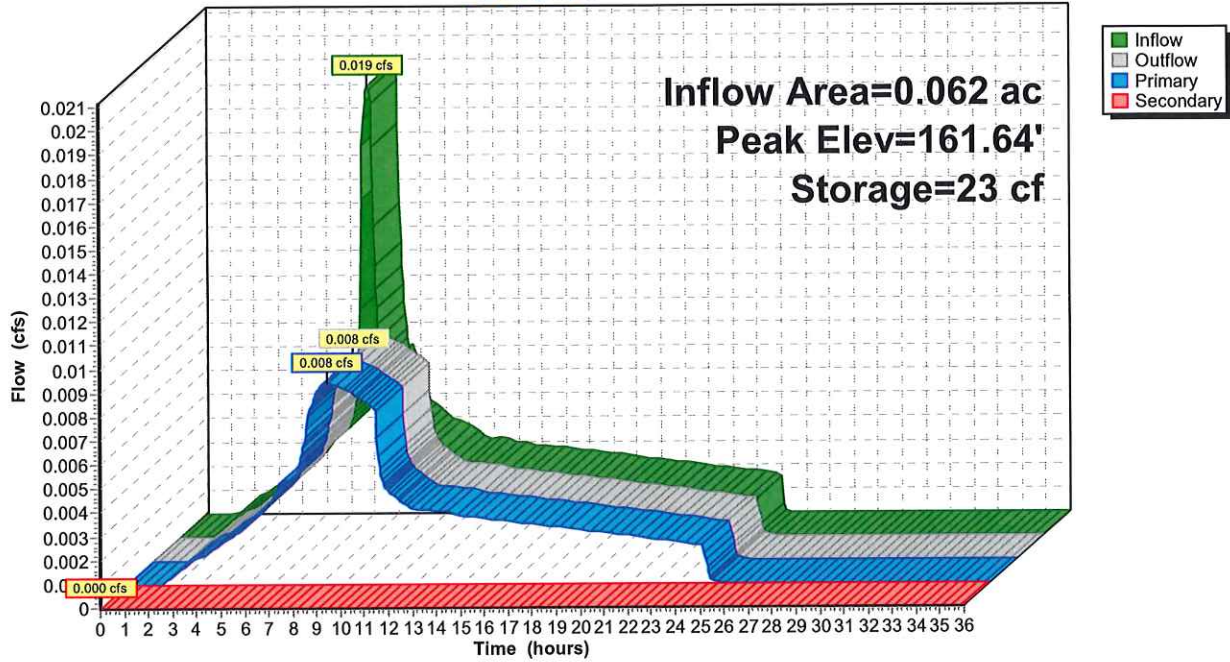
Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	2.000 in/hr Exfiltration over Surface area
#2	Device 3	162.40'	27.000" W x 32.000" H 30° Emergency Overflow CB C= 0.600 Limited to weir flow at low heads
#3	Secondary	160.40'	8.000" Vert. Outlet Pipe C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.008 cfs @ 8.34 hrs HW=161.64' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.008 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=161.50' (Free Discharge)
 ↑3=Outlet Pipe (Passes 0.000 cfs of 1.472 cfs potential flow)
 ↑2=Emergency Overflow CB (Controls 0.000 cfs)

Pond 1G: Growing Media

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Pond 1P: Drain Rock

Inflow Area = 0.062 ac, 100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
 Inflow = 0.008 cfs @ 8.34 hrs, Volume= 0.006 af
 Outflow = 0.008 cfs @ 8.35 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.4 min
 Discarded = 0.008 cfs @ 8.35 hrs, Volume= 0.006 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 159.75' @ 8.35 hrs Surf.Area= 154 sf Storage= 0 cf

Plug-Flow detention time= 0.4 min calculated for 0.006 af (100% of inflow)
 Center-of-Mass det. time= 0.4 min (711.1 - 710.7)

Volume	Invert	Avail.Storage	Storage Description
#1	159.75'	46 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 154 cf Overall x 30.0% Voids

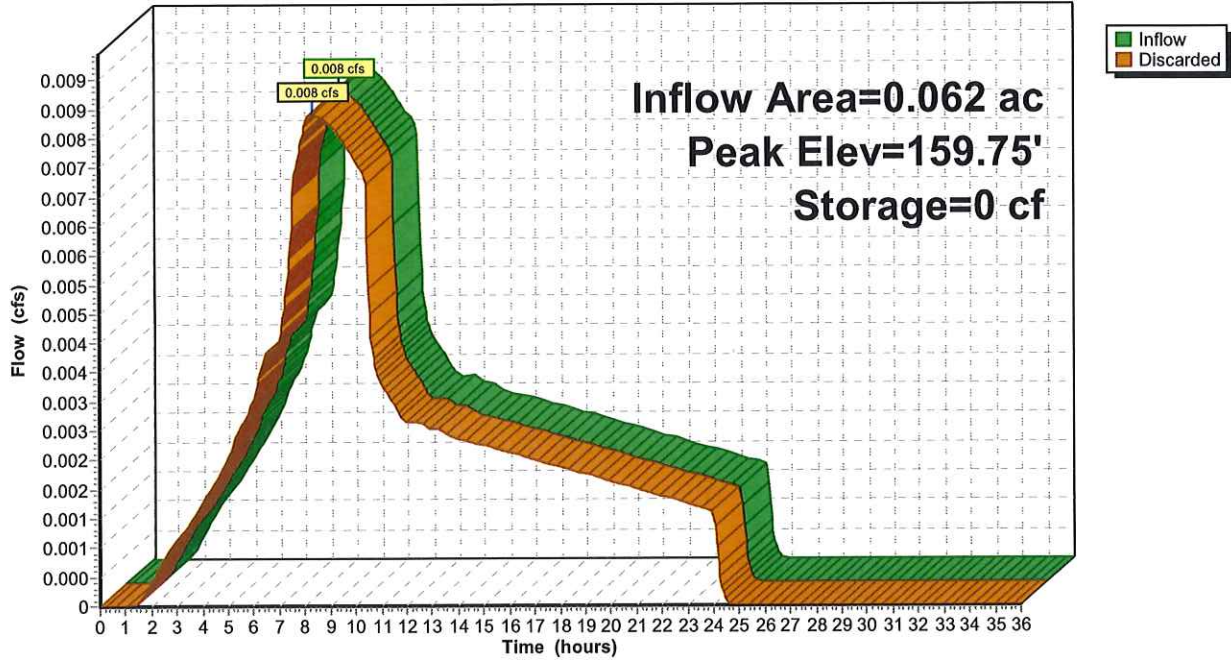
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
159.75	154	0	0
160.75	154	154	154

Device	Routing	Invert	Outlet Devices
#1	Discarded	159.75'	6.000 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.021 cfs @ 8.35 hrs HW=159.75' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.021 cfs)

Pond 1P: Drain Rock

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Subcatchment 2: North Side Road and Sidewalk

Runoff = 0.021 cfs @ 7.87 hrs, Volume= 0.007 af, Depth= 1.16"
 Routed to Pond 2G : Growing Media

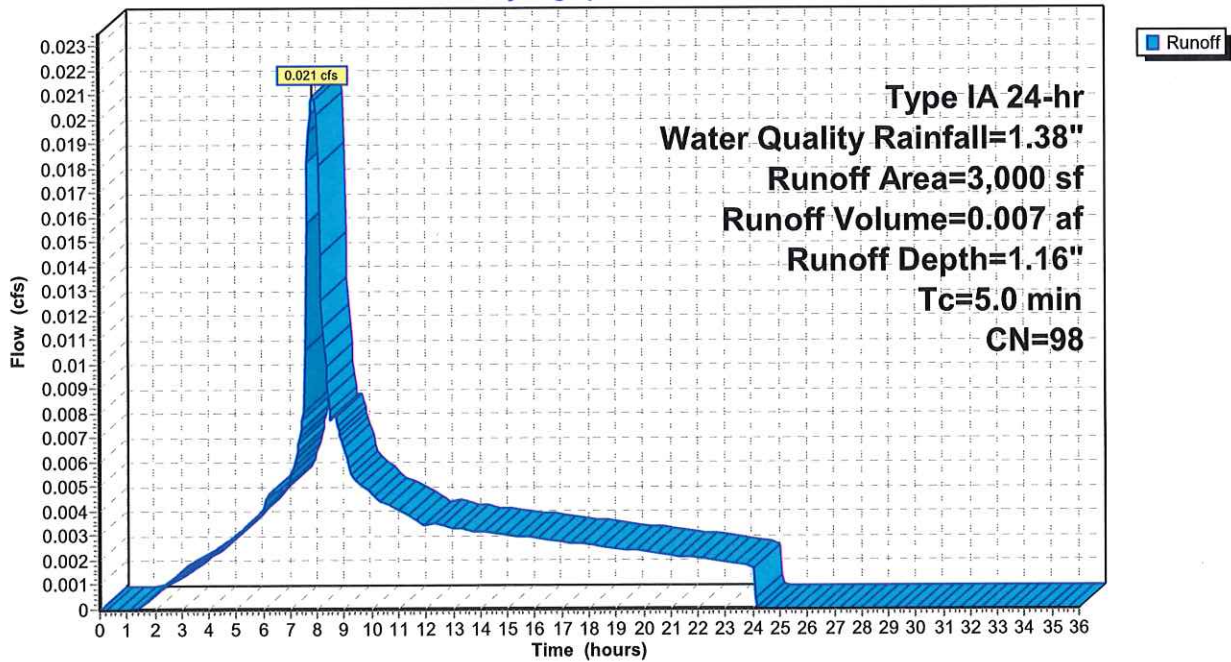
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
3,000	98	Paved parking, HSG C
3,000		100.00% Impervious Area

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

Subcatchment 2: North Side Road and Sidewalk

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Pond 2G: Growing Media

Inflow Area = 0.069 ac, 100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
 Inflow = 0.021 cfs @ 7.87 hrs, Volume= 0.007 af
 Outflow = 0.008 cfs @ 7.55 hrs, Volume= 0.007 af, Atten= 61%, Lag= 0.0 min
 Primary = 0.008 cfs @ 7.55 hrs, Volume= 0.007 af
 Routed to Pond 2P : Drain Rock
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond 2P : Drain Rock

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 164.15' @ 8.46 hrs Surf.Area= 175 sf Storage= 26 cf

Plug-Flow detention time= 13.7 min calculated for 0.007 af (100% of inflow)
 Center-of-Mass det. time= 13.6 min (709.0 - 695.4)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	131 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
164.00	175	0	0
164.75	175	131	131

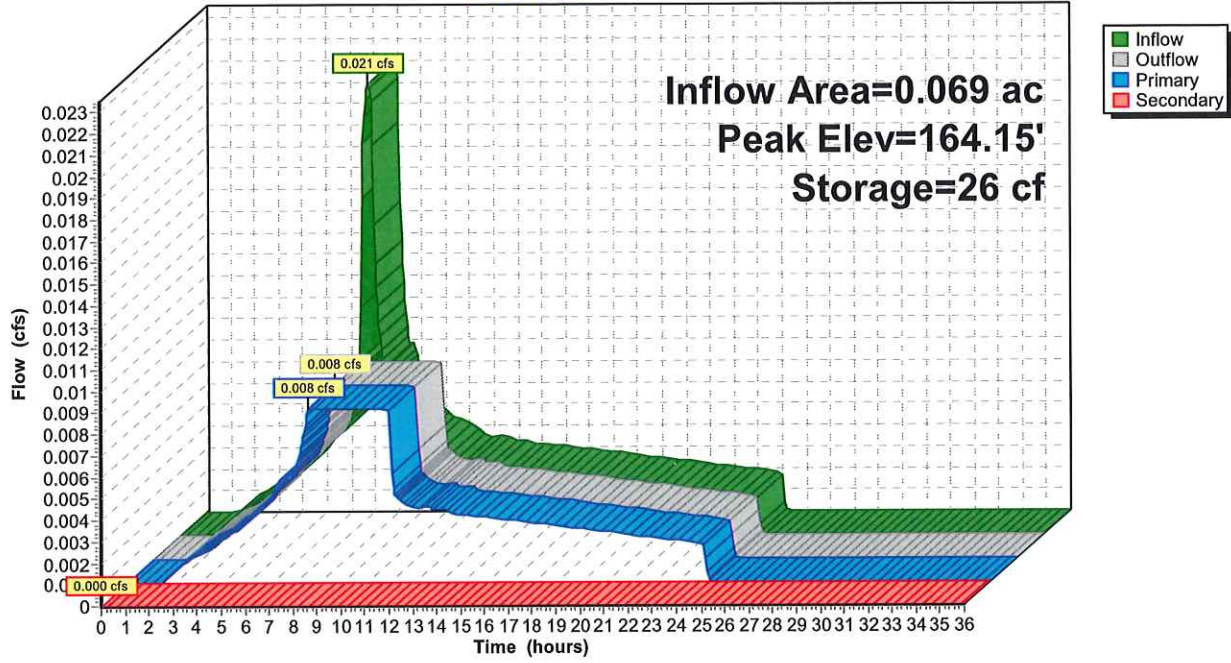
Device	Routing	Invert	Outlet Devices
#1	Primary	164.00'	2.000 in/hr Exfiltration over Surface area
#2	Device 3	164.33'	16.000" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Secondary	161.75'	6.000" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.008 cfs @ 7.55 hrs HW=164.01' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.008 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=164.00' (Free Discharge)
 ↑ **3=Orifice/Grate** (Passes 0.000 cfs of 1.337 cfs potential flow)
 ↑ **2=Orifice/Grate** (Controls 0.000 cfs)

Pond 2G: Growing Media

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Pond 2P: Drain Rock

Inflow Area = 0.069 ac, 100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
 Inflow = 0.008 cfs @ 7.55 hrs, Volume= 0.007 af
 Outflow = 0.008 cfs @ 8.25 hrs, Volume= 0.007 af, Atten= 0%, Lag= 42.0 min
 Discarded = 0.008 cfs @ 8.25 hrs, Volume= 0.007 af
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 158.77' @ 8.05 hrs Surf.Area= 140 sf Storage= 1 cf

Plug-Flow detention time= 1.7 min calculated for 0.007 af (100% of inflow)
 Center-of-Mass det. time= 1.7 min (710.8 - 709.0)

Volume	Invert	Avail.Storage	Storage Description
#1	158.75'	168 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 560 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.75	140	0	0
162.75	140	560	560

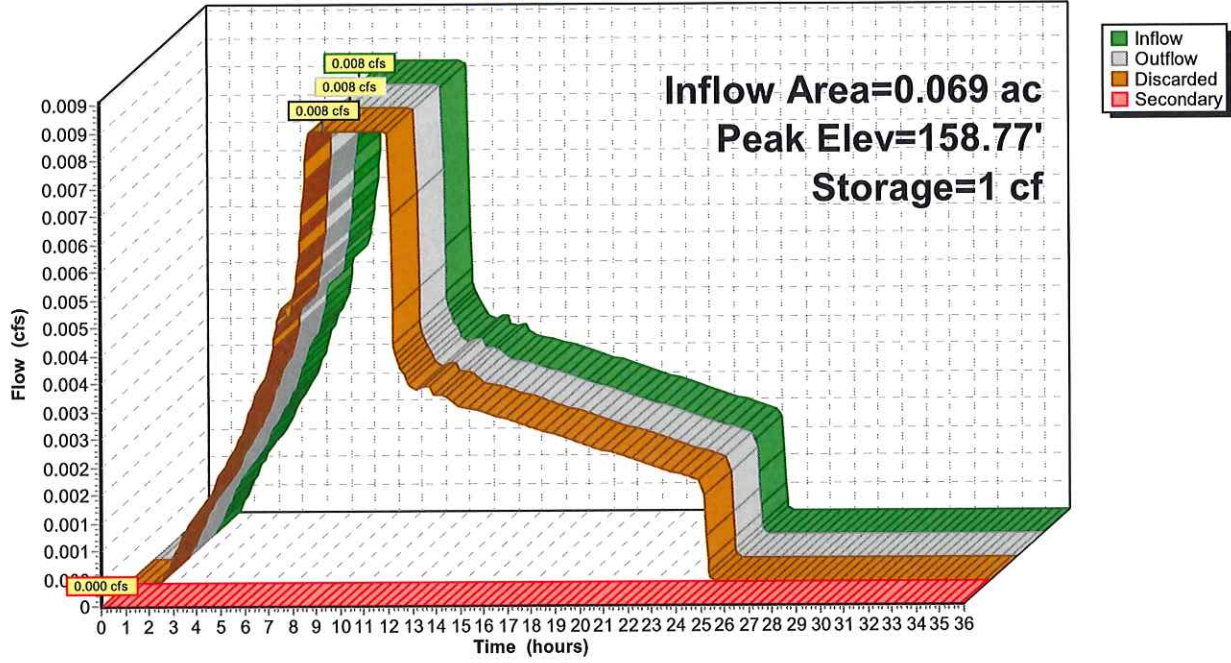
Device	Routing	Invert	Outlet Devices
#1	Discarded	158.75'	6.000 in/hr Exfiltration over Surface area
#2	Secondary	162.75'	10.000" Vert. Emergency Overflow Pipe C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.019 cfs @ 8.25 hrs HW=158.77' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.019 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=158.75' (Free Discharge)
 ↑2=Emergency Overflow Pipe (Controls 0.000 cfs)

Pond 2P: Drain Rock

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Subcatchment 3: South Side Road and Sidewalk

Runoff = 0.049 cfs @ 7.87 hrs, Volume= 0.016 af, Depth= 1.16"
Routed to Pond 3G : Growing Media

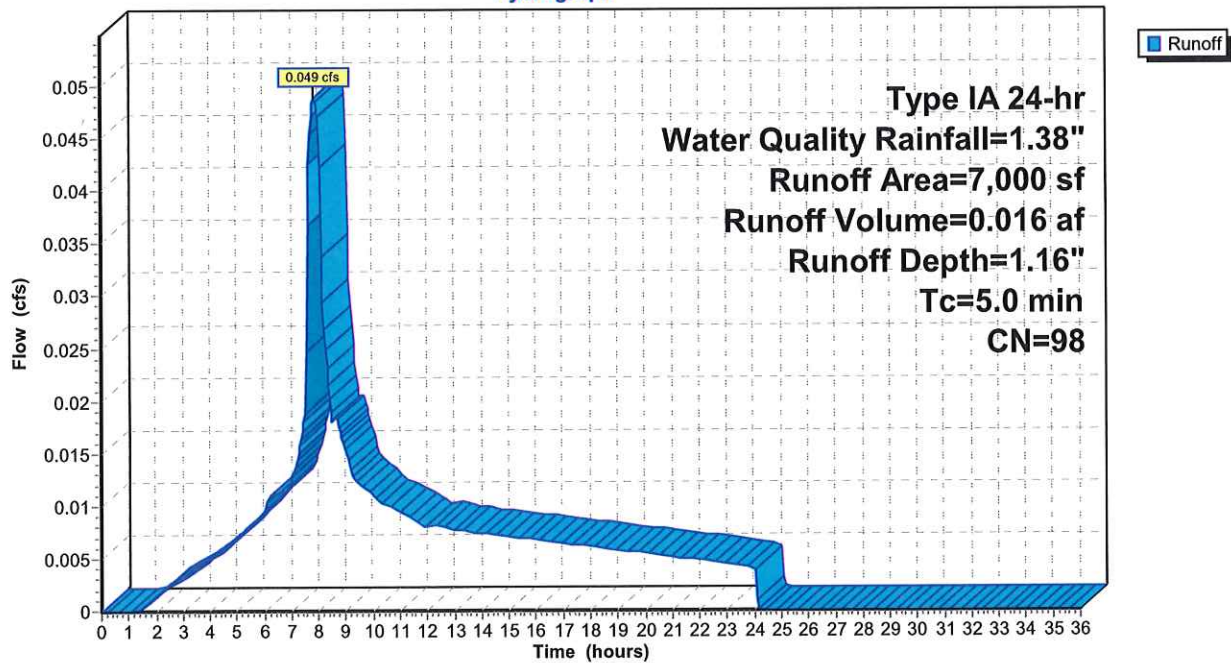
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (sf)	CN	Description
* 7,000	98	
7,000		100.00% Impervious Area

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

Subcatchment 3: South Side Road and Sidewalk

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Pond 3G: Growing Media

Inflow Area = 0.161 ac, 100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
 Inflow = 0.049 cfs @ 7.87 hrs, Volume= 0.016 af
 Outflow = 0.014 cfs @ 7.20 hrs, Volume= 0.016 af, Atten= 72%, Lag= 0.0 min
 Primary = 0.014 cfs @ 7.20 hrs, Volume= 0.016 af
 Routed to Pond 3P : Drain Rock
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af
 Routed to Pond 3P : Drain Rock

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 163.79' @ 9.14 hrs Surf.Area= 300 sf Storage= 88 cf

Plug-Flow detention time= 35.0 min calculated for 0.016 af (100% of inflow)
 Center-of-Mass det. time= 34.9 min (730.3 - 695.4)

Volume	Invert	Avail.Storage	Storage Description
#1	163.50'	300 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
163.50	300	0	0
164.50	300	300	300

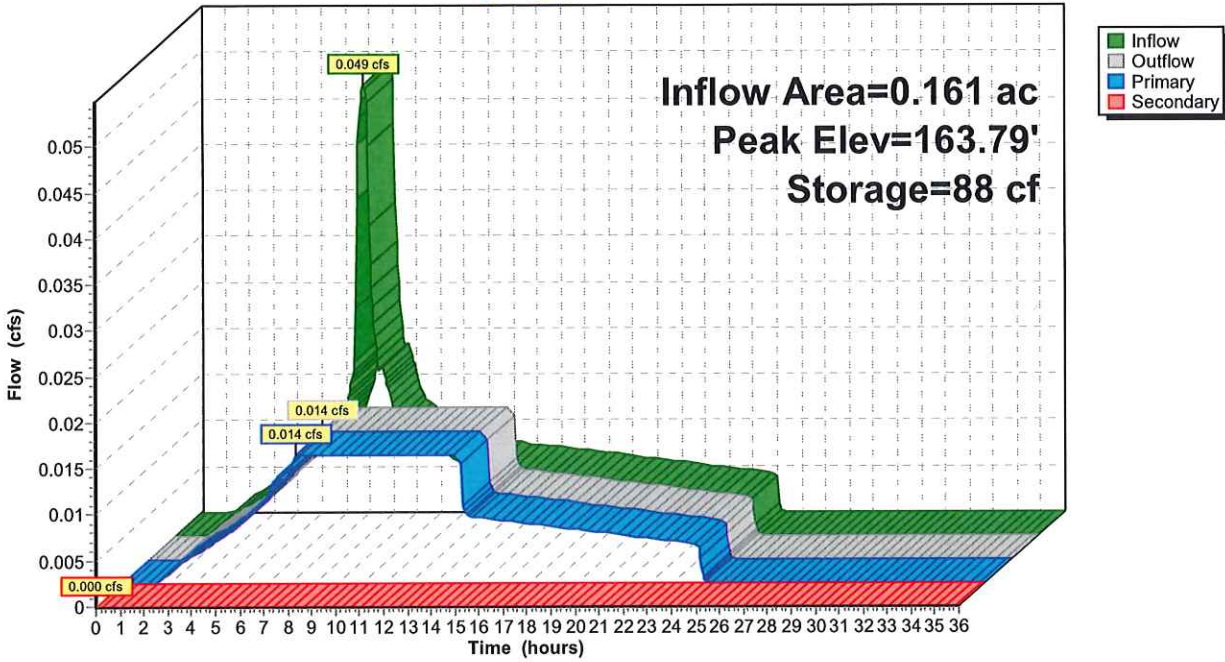
Device	Routing	Invert	Outlet Devices
#1	Primary	163.50'	2.000 in/hr Exfiltration over Surface area
#2	Device 3	163.83'	16.000" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Secondary	161.25'	6.000" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.014 cfs @ 7.20 hrs HW=163.51' (Free Discharge)
 ↳1=Exfiltration (Exfiltration Controls 0.014 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=163.50' (Free Discharge)
 ↳3=Orifice/Grate (Passes 0.000 cfs of 1.337 cfs potential flow)
 ↳2=Orifice/Grate (Controls 0.000 cfs)

Pond 3G: Growing Media

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr Water Quality Rainfall=1.38"

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Summary for Pond 3P: Drain Rock

Inflow Area = 0.161 ac, 100.00% Impervious, Inflow Depth = 1.16" for Water Quality event
 Inflow = 0.014 cfs @ 7.20 hrs, Volume= 0.016 af
 Outflow = 0.014 cfs @ 7.90 hrs, Volume= 0.016 af, Atten= 0%, Lag= 42.0 min
 Discarded = 0.014 cfs @ 7.90 hrs, Volume= 0.016 af
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 158.27' @ 7.70 hrs Surf.Area= 300 sf Storage= 1 cf

Plug-Flow detention time= 1.7 min calculated for 0.016 af (100% of inflow)
 Center-of-Mass det. time= 1.7 min (732.1 - 730.3)

Volume	Invert	Avail.Storage	Storage Description
#1	158.25'	360 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 1,200 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.25	300	0	0
162.25	300	1,200	1,200

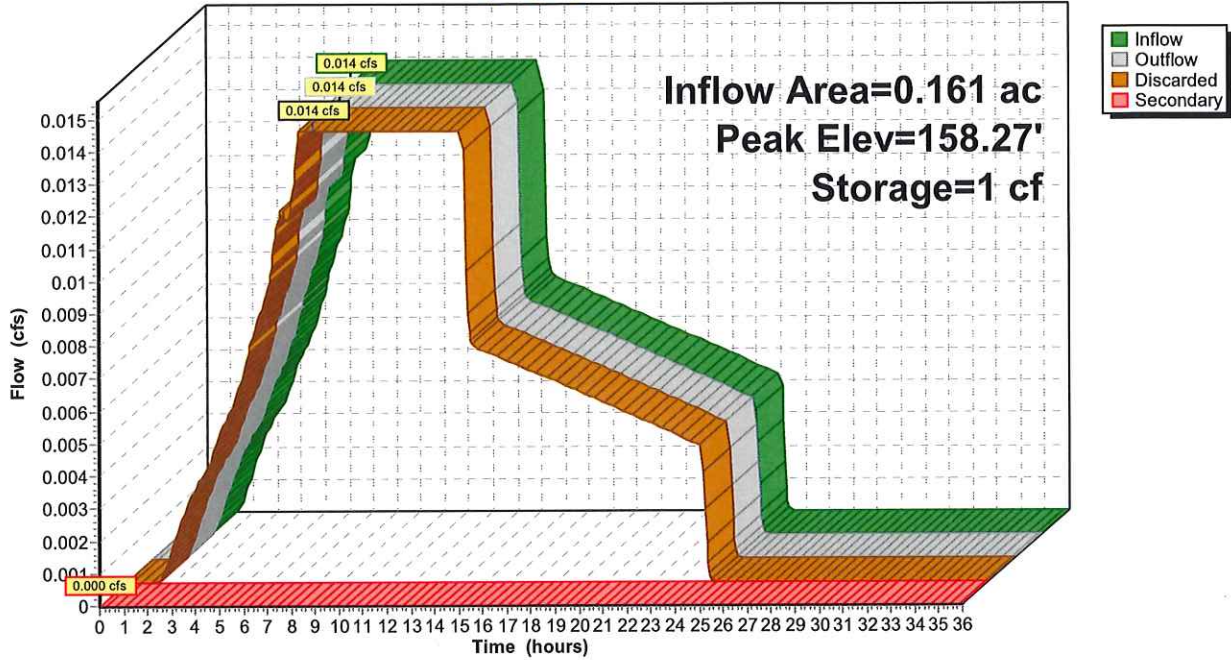
Device	Routing	Invert	Outlet Devices
#1	Discarded	158.25'	6.000 in/hr Exfiltration over Surface area
#2	Secondary	162.25'	10.000" Vert. Emergency Overflow Pipe C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.042 cfs @ 7.90 hrs HW=158.27' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.042 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=158.25' (Free Discharge)
 ↑2=Emergency Overflow Pipe (Controls 0.000 cfs)

Pond 3P: Drain Rock

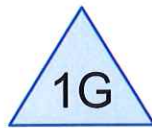
Hydrograph



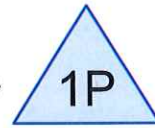
APPENDIX E: WATER QUANTITY HYDROGRAPHS



Roof & Driveway



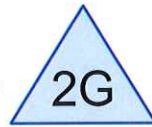
Growing Media



Drain Rock



North Side Road and Sidewalk



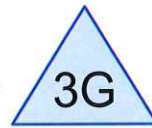
Growing Media



Drain Rock



South Side Road and Sidewalk



Growing Media



Drain Rock



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Page 2

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	100-year	Type IA 24-hr		Default	24.00	1	4.40	2

7642 Preliminary Drainage HydroCAD

Type IA 24-hr 100-year Rainfall=4.40"

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Page 3

Summary for Subcatchment 1: Roof & Driveway

Runoff = 0.065 cfs @ 7.86 hrs, Volume= 0.022 af, Depth= 4.16"
 Routed to Pond 1G : Growing Media

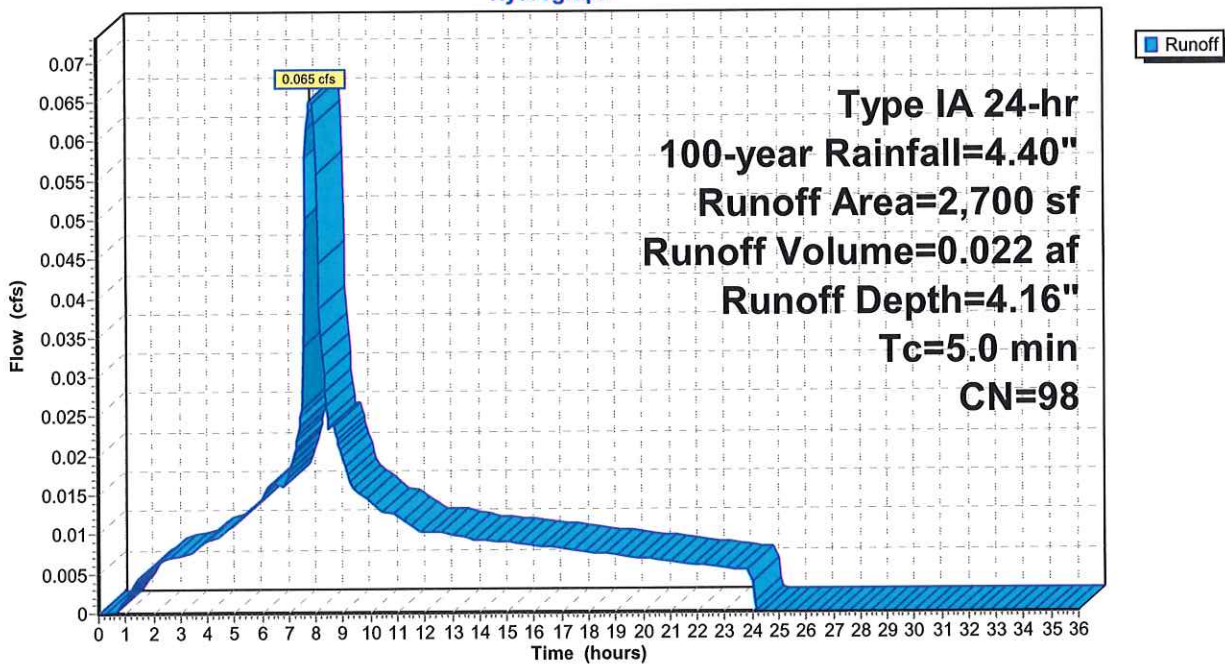
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 100-year Rainfall=4.40"

Area (sf)	CN	Description
2,700	98	Paved parking, HSG C
2,700		100.00% Impervious Area

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

Subcatchment 1: Roof & Driveway

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Pond 1G: Growing Media

Inflow Area = 0.062 ac, 100.00% Impervious, Inflow Depth = 4.16" for 100-year event
 Inflow = 0.065 cfs @ 7.86 hrs, Volume= 0.022 af
 Outflow = 0.015 cfs @ 9.49 hrs, Volume= 0.022 af, Atten= 77%, Lag= 97.9 min
 Primary = 0.015 cfs @ 9.49 hrs, Volume= 0.022 af
 Routed to Pond 1P : Drain Rock
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 162.37' @ 9.49 hrs Surf.Area= 331 sf Storage= 211 cf

Plug-Flow detention time= 139.8 min calculated for 0.022 af (100% of inflow)
 Center-of-Mass det. time= 139.7 min (796.4 - 656.7)

Volume	Invert	Avail.Storage	Storage Description
#1	161.50'	461 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
161.50	154	0	0
163.00	460	461	461

Device	Routing	Invert	Outlet Devices
#1	Primary	161.50'	2.000 in/hr Exfiltration over Surface area
#2	Device 3	162.40'	27.000" W x 32.000" H 30° Emergency Overflow CB C= 0.600 Limited to weir flow at low heads
#3	Secondary	160.40'	8.000" Vert. Outlet Pipe C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.015 cfs @ 9.49 hrs HW=162.37' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.015 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=161.50' (Free Discharge)
 ↑3=Outlet Pipe (Passes 0.000 cfs of 1.472 cfs potential flow)
 ↑2=Emergency Overflow CB (Controls 0.000 cfs)

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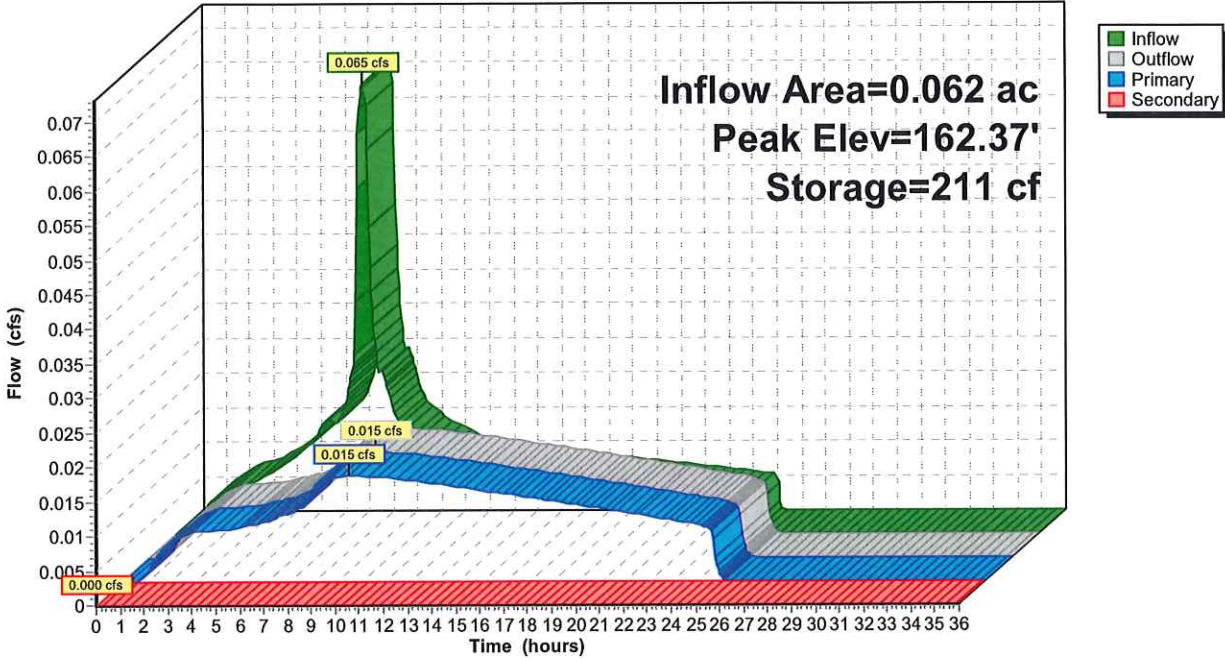
Type IA 24-hr 100-year Rainfall=4.40"

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Pond 1G: Growing Media

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Pond 1P: Drain Rock

Inflow Area = 0.062 ac, 100.00% Impervious, Inflow Depth = 4.16" for 100-year event
 Inflow = 0.015 cfs @ 9.49 hrs, Volume= 0.022 af
 Outflow = 0.015 cfs @ 9.49 hrs, Volume= 0.022 af, Atten= 0%, Lag= 0.5 min
 Discarded = 0.015 cfs @ 9.49 hrs, Volume= 0.022 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 159.76' @ 9.49 hrs Surf.Area= 154 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.4 min (796.8 - 796.4)

Volume	Invert	Avail.Storage	Storage Description
#1	159.75'	46 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 154 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
159.75	154	0	0
160.75	154	154	154

Device	Routing	Invert	Outlet Devices
#1	Discarded	159.75'	6.000 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.021 cfs @ 9.49 hrs HW=159.76' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.021 cfs)

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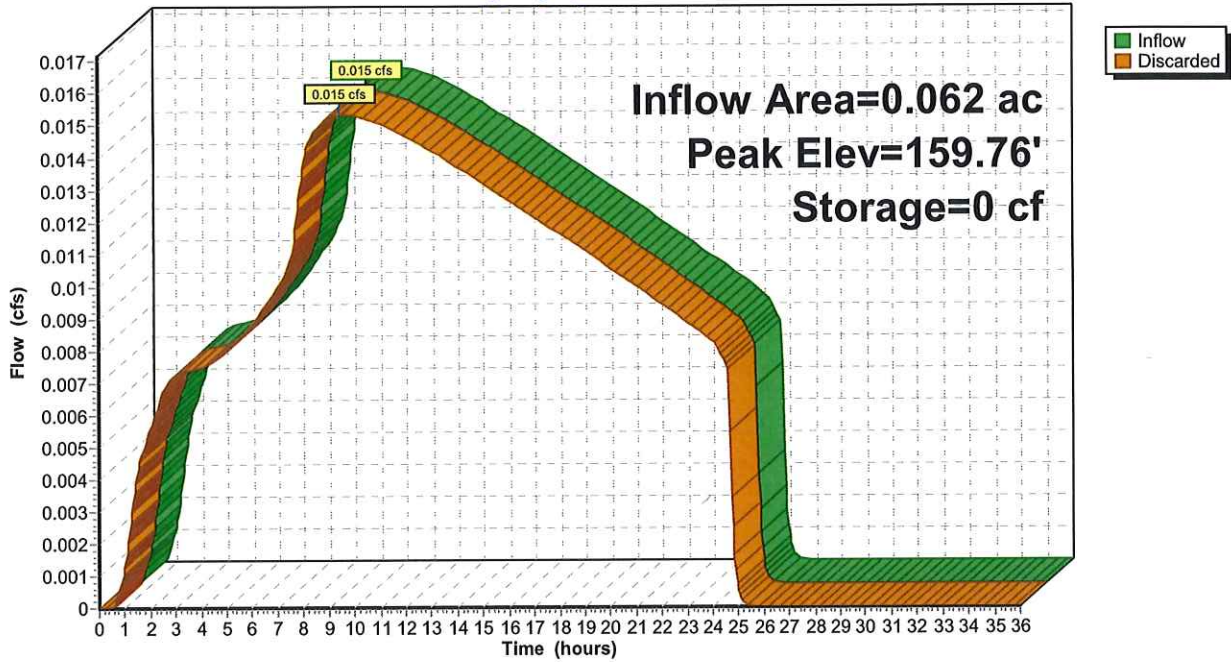
Type IA 24-hr 100-year Rainfall=4.40"

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Pond 1P: Drain Rock

Hydrograph



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Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Subcatchment 2: North Side Road and Sidewalk

Runoff = 0.073 cfs @ 7.86 hrs, Volume= 0.024 af, Depth= 4.16"
Routed to Pond 2G : Growing Media

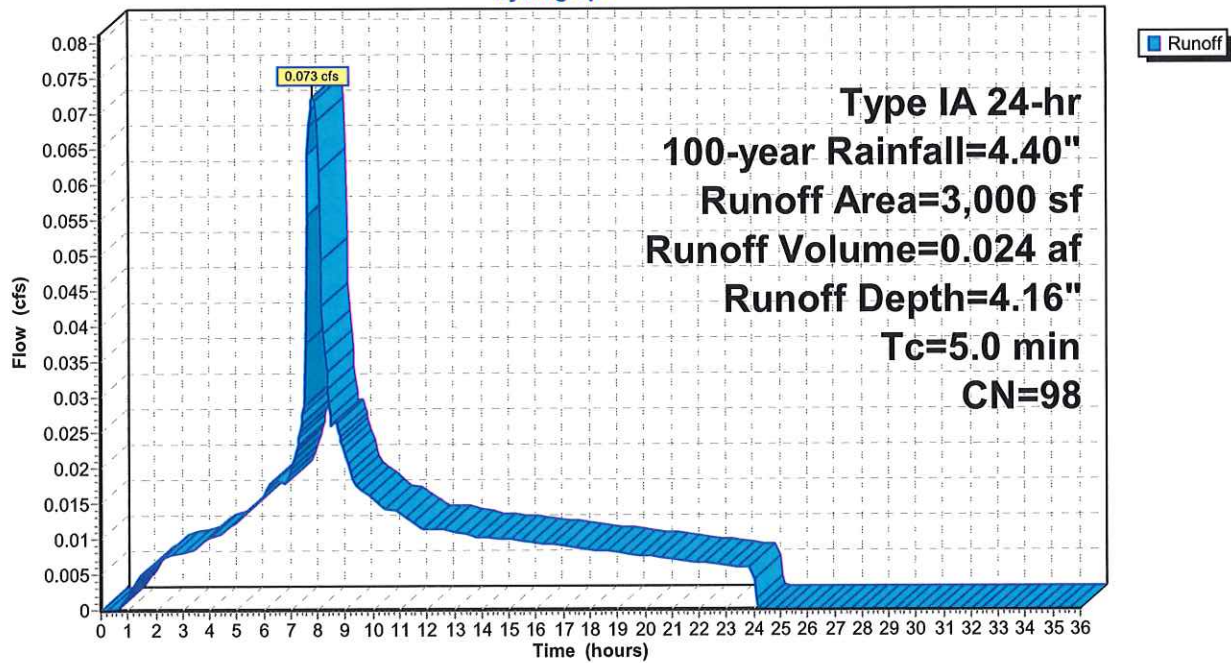
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-year Rainfall=4.40"

Area (sf)	CN	Description
3,000	98	Paved parking, HSG C
3,000		100.00% Impervious Area

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

Subcatchment 2: North Side Road and Sidewalk

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Pond 2G: Growing Media

Inflow Area = 0.069 ac, 100.00% Impervious, Inflow Depth = 4.16" for 100-year event
 Inflow = 0.073 cfs @ 7.86 hrs, Volume= 0.024 af
 Outflow = 0.073 cfs @ 7.87 hrs, Volume= 0.024 af, Atten= 0%, Lag= 0.9 min
 Primary = 0.008 cfs @ 2.95 hrs, Volume= 0.016 af
 Routed to Pond 2P : Drain Rock
 Secondary = 0.064 cfs @ 7.87 hrs, Volume= 0.008 af
 Routed to Pond 2P : Drain Rock

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 164.36' @ 7.87 hrs Surf.Area= 175 sf Storage= 63 cf

Plug-Flow detention time= 61.8 min calculated for 0.024 af (100% of inflow)
 Center-of-Mass det. time= 61.9 min (718.6 - 656.7)

Volume	Invert	Avail.Storage	Storage Description
#1	164.00'	131 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
164.00	175	0	0
164.75	175	131	131

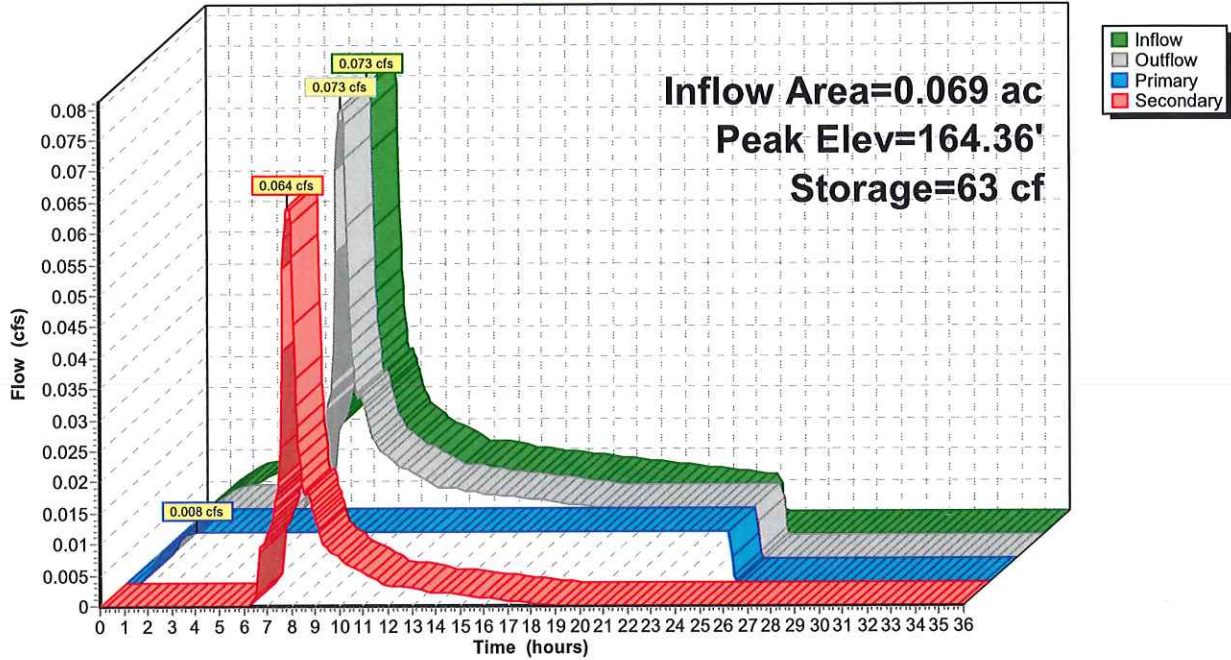
Device	Routing	Invert	Outlet Devices
#1	Primary	164.00'	2.000 in/hr Exfiltration over Surface area
#2	Device 3	164.33'	16.000" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Secondary	161.75'	6.000" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.008 cfs @ 2.95 hrs HW=164.01' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.008 cfs)

Secondary OutFlow Max=0.064 cfs @ 7.87 hrs HW=164.36' (Free Discharge)
 ↑3=Orifice/Grate (Passes 0.064 cfs of 1.452 cfs potential flow)
 ↑2=Orifice/Grate (Weir Controls 0.064 cfs @ 0.55 fps)

Pond 2G: Growing Media

Hydrograph



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Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Pond 2P: Drain Rock

Inflow Area = 0.069 ac, 100.00% Impervious, Inflow Depth = 4.16" for 100-year event
 Inflow = 0.073 cfs @ 7.87 hrs, Volume= 0.024 af
 Outflow = 0.019 cfs @ 7.05 hrs, Volume= 0.024 af, Atten= 73%, Lag= 0.0 min
 Discarded = 0.019 cfs @ 7.05 hrs, Volume= 0.024 af
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 161.99' @ 9.20 hrs Surf.Area= 140 sf Storage= 136 cf

Plug-Flow detention time= 36.8 min calculated for 0.024 af (100% of inflow)
 Center-of-Mass det. time= 36.8 min (755.4 - 718.6)

Volume	Invert	Avail.Storage	Storage Description
#1	158.75'	168 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 560 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.75	140	0	0
162.75	140	560	560

Device	Routing	Invert	Outlet Devices
#1	Discarded	158.75'	6.000 in/hr Exfiltration over Surface area
#2	Secondary	162.75'	10.000" Vert. Emergency Overflow Pipe C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.019 cfs @ 7.05 hrs HW=158.80' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.019 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=158.75' (Free Discharge)
 ↑2=Emergency Overflow Pipe (Controls 0.000 cfs)

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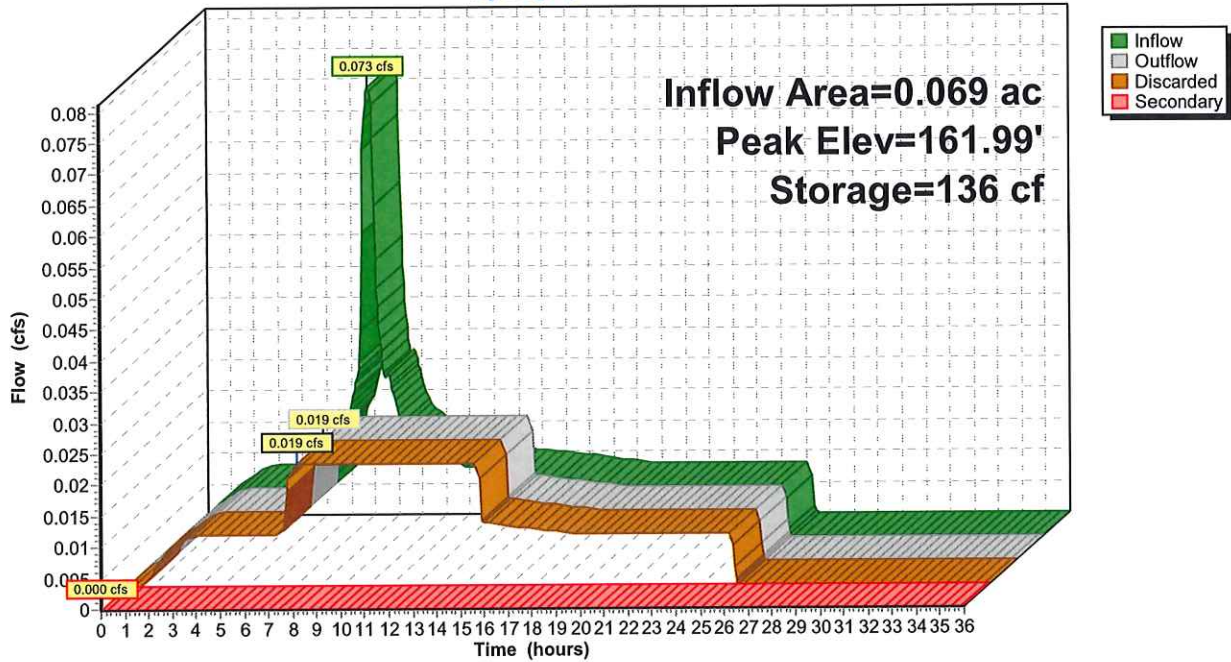
Type IA 24-hr 100-year Rainfall=4.40"

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Pond 2P: Drain Rock

Hydrograph



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Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Subcatchment 3: South Side Road and Sidewalk

Runoff = 0.169 cfs @ 7.86 hrs, Volume= 0.056 af, Depth= 4.16"
 Routed to Pond 3G : Growing Media

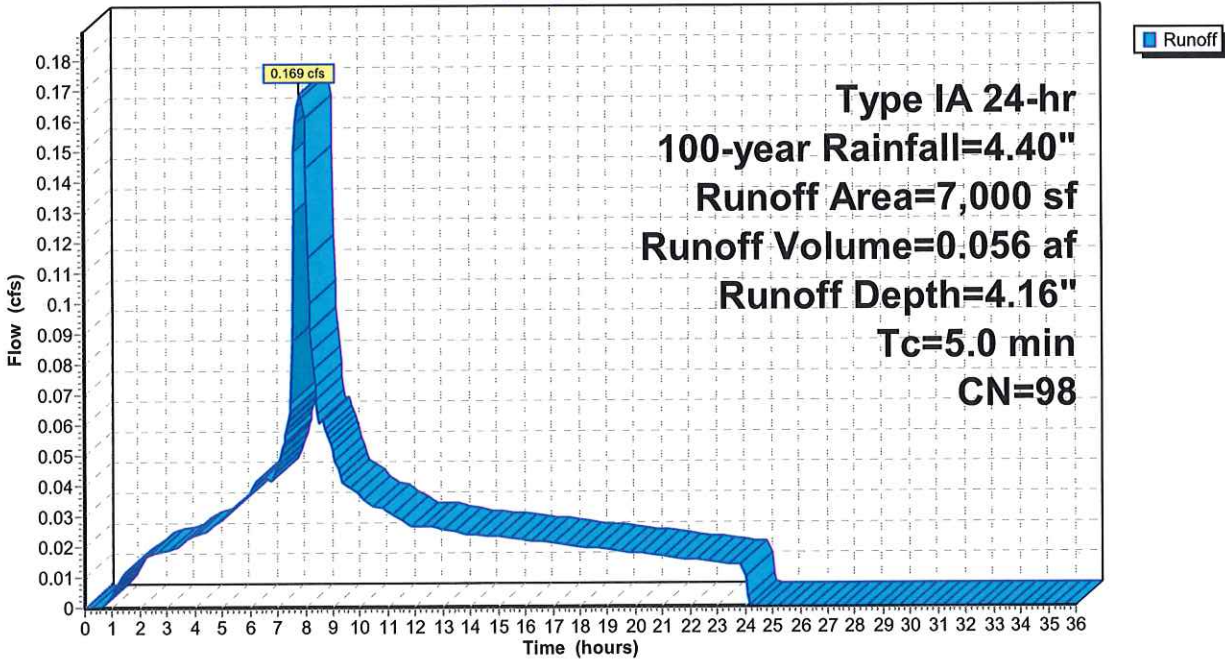
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Type IA 24-hr 100-year Rainfall=4.40"

Area (sf)	CN	Description
* 7,000	98	
7,000		100.00% Impervious Area

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

Subcatchment 3: South Side Road and Sidewalk

Hydrograph



7642 Preliminary Drainage HydroCAD

Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Pond 3G: Growing Media

Inflow Area = 0.161 ac, 100.00% Impervious, Inflow Depth = 4.16" for 100-year event
 Inflow = 0.169 cfs @ 7.86 hrs, Volume= 0.056 af
 Outflow = 0.169 cfs @ 7.87 hrs, Volume= 0.056 af, Atten= 0%, Lag= 1.0 min
 Primary = 0.014 cfs @ 1.90 hrs, Volume= 0.029 af
 Routed to Pond 3P : Drain Rock
 Secondary = 0.155 cfs @ 7.87 hrs, Volume= 0.027 af
 Routed to Pond 3P : Drain Rock

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 163.88' @ 7.87 hrs Surf.Area= 300 sf Storage= 114 cf

Plug-Flow detention time= 52.8 min calculated for 0.056 af (100% of inflow)
 Center-of-Mass det. time= 52.9 min (709.6 - 656.7)

Volume	Invert	Avail.Storage	Storage Description
#1	163.50'	300 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
163.50	300	0	0
164.50	300	300	300

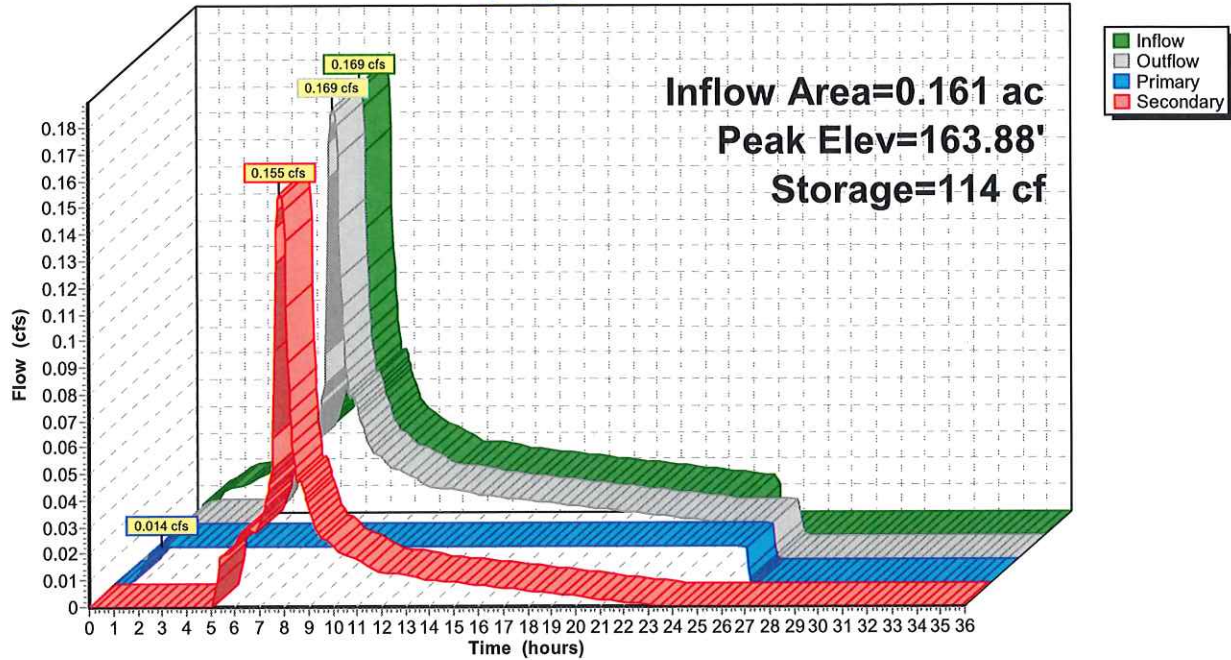
Device	Routing	Invert	Outlet Devices
#1	Primary	163.50'	2.000 in/hr Exfiltration over Surface area
#2	Device 3	163.83'	16.000" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Secondary	161.25'	6.000" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.014 cfs @ 1.90 hrs HW=163.51' (Free Discharge)
 ↑ **1=Exfiltration** (Exfiltration Controls 0.014 cfs)

Secondary OutFlow Max=0.155 cfs @ 7.87 hrs HW=163.88' (Free Discharge)
 ↑ **3=Orifice/Grate** (Passes 0.155 cfs of 1.459 cfs potential flow)
 ↑ **2=Orifice/Grate** (Weir Controls 0.155 cfs @ 0.73 fps)

Pond 3G: Growing Media

Hydrograph



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Type IA 24-hr 100-year Rainfall=4.40"

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Summary for Pond 3P: Drain Rock

Inflow Area = 0.161 ac, 100.00% Impervious, Inflow Depth = 4.16" for 100-year event
 Inflow = 0.169 cfs @ 7.87 hrs, Volume= 0.056 af
 Outflow = 0.042 cfs @ 6.30 hrs, Volume= 0.056 af, Atten= 75%, Lag= 0.0 min
 Discarded = 0.042 cfs @ 6.30 hrs, Volume= 0.056 af
 Secondary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 162.14' @ 9.39 hrs Surf.Area= 300 sf Storage= 350 cf

Plug-Flow detention time= 49.3 min calculated for 0.056 af (100% of inflow)
 Center-of-Mass det. time= 49.2 min (758.8 - 709.6)

Volume	Invert	Avail.Storage	Storage Description
#1	158.25'	360 cf	Custom Stage Data (Prismatic) Listed below (Recalc) 1,200 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
158.25	300	0	0
162.25	300	1,200	1,200

Device	Routing	Invert	Outlet Devices
#1	Discarded	158.25'	6.000 in/hr Exfiltration over Surface area
#2	Secondary	162.25'	10.000" Vert. Emergency Overflow Pipe C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.042 cfs @ 6.30 hrs HW=158.30' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.042 cfs)

Secondary OutFlow Max=0.000 cfs @ 0.00 hrs HW=158.25' (Free Discharge)
 ↑2=Emergency Overflow Pipe (Controls 0.000 cfs)

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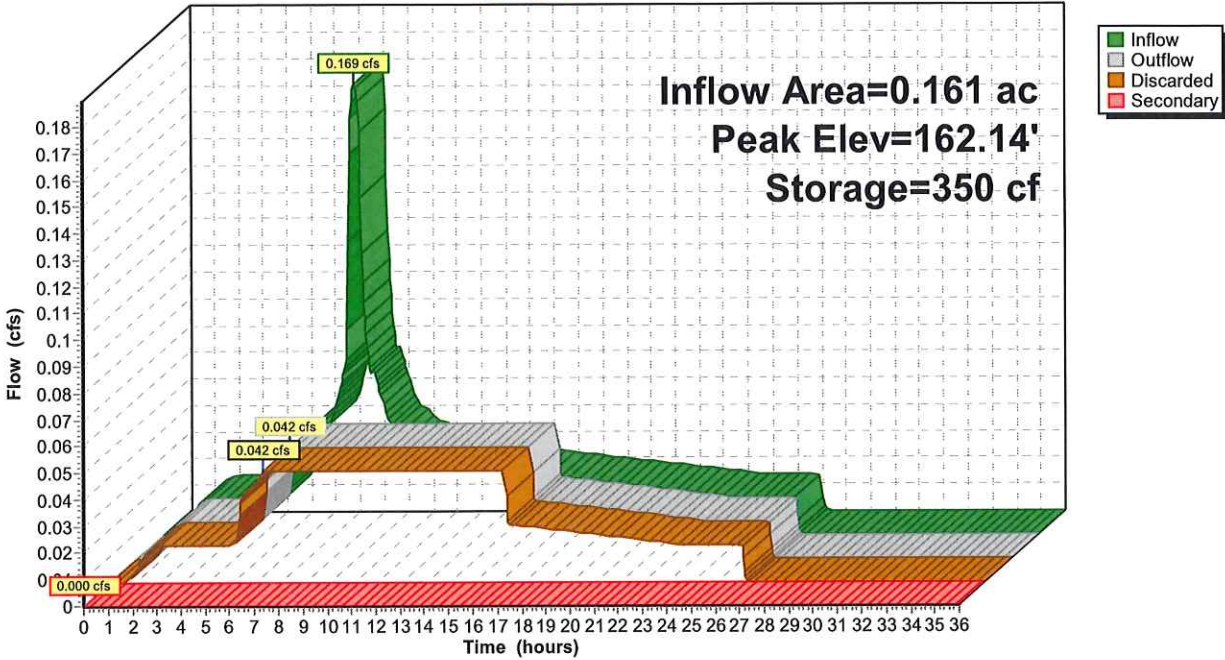
Type IA 24-hr 100-year Rainfall=4.40"

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Pond 3P: Drain Rock

Hydrograph





APPENDIX F: OPERATING AND MAINTENANCE

Chapter 109
Division 011 - Operations and Maintenance of Stormwater Facilities
Appendix B to 109-011 – Facility Maintenance Forms

2. Rain Garden

A rain garden is a **vegetated infiltration basin** or depression created by excavation, berms, or small dams to provide for short-term ponding of surface water until it percolates into the soil. The basin should infiltrate stormwater within 24 hours.

Inspections

All facility components and vegetation shall be inspected for proper operations and structural stability. *These inspections shall occur, at a minimum, quarterly for the first two years from the date of installation, and two times per year thereafter.* It is recommended that a visual inspection be made within 48 hours after each major storm event to ensure proper function. The facility owner must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Date: ___ / ___ / _____ Inspector's Name: _____

Basin inlet shall ensure unrestricted stormwater flow to the vegetated basin.

- Sources of erosion shall be identified and controlled when native soil is exposed or erosion channels are present.
- Inlet shall be kept clear at all times.
- Rock splash pads shall be replenished to prevent erosion.

Inspection Comments: _____

Embankment, dikes, berms, and side slopes retain water in the infiltration basin.

- Structural deficiencies shall be corrected upon discovery.
- Slopes shall be stabilized using appropriate erosion control measures when soil is exposed/flow channels are forming.
- Sources of erosion damage shall be identified and controlled.

Inspection Comments: _____

Overflow or emergency spillway conveys flow exceeding reservoir capacity to an approved stormwater receiving system.

- Overflow shall be kept clear at all times.
- Sources of erosion damage shall be identified and controlled when soil is exposed.
- Rocks or other armament shall be replaced when only one layer of rock exists.

Inspection Comments: _____

Amended soils shall allow stormwater to percolate uniformly through the infiltration basin. If water remains 36 hours after a storm, sources of possible clogging shall be identified and corrected.

- Basin shall be raked and, if necessary, soil shall be excavated and cleaned or replaced.

Inspection Comments: _____

Chapter 109
Division 011 - Operations and Maintenance of Stormwater Facilities
Appendix B to 109-011 – Facility Maintenance Forms

2. Rain Garden (continued)

Sediment/Basin debris management shall prevent loss of infiltration basin volume caused by sedimentation.

- Sediment exceeding 3 inches in depth, or so thick as to damage or kill vegetation, shall be removed.
- Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures.

Inspection Comments: _____

Debris and litter shall be removed to ensure stormwater infiltration and to prevent clogging of overflow drains and interference with plant growth.

- Restricted sources of sediment and debris, such as discarded lawn clippings, shall be identified and prevented.

Inspection Comments: _____

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion. Proper horticultural practices shall be employed to ensure that plants are vigorous and healthy.

- Mulch shall be replenished as needed, but not inhibiting water flow.
- Vegetation, large shrubs, or trees that interfere with rain garden operation shall be pruned.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed.
- Nuisance or prohibited vegetation from the City of Salem Non-Native Invasive Plant list shall be removed when discovered. Invasive vegetation shall be removed immediately upon discovery.
- Dead vegetation shall be removed upon discovery.
- Vegetation shall be replaced as soon as possible to maintain cover density and control erosion where soils are exposed.

Inspection Comments: _____

Spill prevention measures shall be exercised when handling substances that contaminate stormwater.

- Releases of pollutants shall be corrected as soon as identified.

Inspection Comments: _____

Training and/or written guidance information for operating and maintaining vegetated infiltration basins shall be provided to all property owners and tenants. This Facility Maintenance Form can be used to meet this requirement.

Inspection Comments: _____

Access to the infiltration basin shall be safe and efficient. Egress and ingress routes shall be maintained to design standards. Roadways shall be maintained to accommodate size and weight of vehicles, if applicable.

- Obstacles preventing maintenance personnel and/or equipment access to the infiltration basin shall be removed.
- Gravel or ground cover shall be added if erosion has occurred.

Inspection Comments: _____

Chapter 109
Division 011 - Operations and Maintenance of Stormwater Facilities

Appendix B to 109-011 – Facility Maintenance Forms

2. Rain Garden (continued)

Nuisance insects and rodents shall not be harbored in the infiltration basin. Pest control measures shall be taken when nuisance insects/rodents are found to be present.

- Holes in the ground located in and around the infiltration basin shall be filled.

Inspection Comments: _____

If used at this site, the following will be applicable:

Fences shall be maintained to preserve their functionality and appearance.

- Collapsed fences shall be restored to an upright position.
- Jagged edges and damaged fences shall be repaired or replaced.

Inspection Comments: _____
