Harper
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MODERA WEST LINN

MCR-01

Preliminary Stormwater Management Report

May 2026

Prepared For:

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PROJECT OVERVIEW

The project site is located at 2410 to 2444 Tannler Road in the City of West Linn and is comprised of three parcels (Tax Map 21E35C, Tax Lots 00100, 00102, 00200). The site is approximately 11.36 acres in size and is located northwest of the intersection of Tannler Drive and Blankenship Rd. Tannler Drive is located along the east boundary of the site and Blankenship Road is located along the southern boundary of the site. Project proposes to construct a mixed-use development that will consist of 320 units in ten multi-family residential buildings, garages, a clubhouse, accessory uses, and approximately 12,118 square feet of commercial mixed-use space on the ground floor.

Development permits from the City of West Linn are required for the project.

The purpose of this stormwater management report is to present the best management practices (BMPs) for conveyance, flow control, and water quality treatment to be installed as part of the project. BMPs outlined in this report will comply with the City of West Linn Stormwater Management Manual dated May 2025. See Table 1 below for design requirements.

Table 1. West Linn Stormwater Management Criteria

Design Requirement	West Linn Criteria
Project Classification	Large Development (Creates or replaces 10,000 SF or more of impervious surface area) • Use downstream, centralized stormwater management facilities to meet the infiltration, water quality, and flow control standard for all impervious surfaces onsite. Use centralized downstream lined, vegetated facility for public right-of-way.
Flow Control Performance	Match pre-developed discharge rates for the 2-year, 10-year and 25-year, 24-hour storm events using the 'Engineered Method' – Santa Barbara Urban Hydrograph (SBUH) Method using the Soil Conservation Service Type 1-A, 24-hour rainfall distribution.
Water Quality	Stormwater management facilities must treat 80% of the average annual runoff (1 inch per 24 hour period).
Conveyance	Storm pipes shall be sized using the 25-year, 24-hour storm event (SBUH).
Downstream Analysis	Demonstrate adequate conveyance capacity to the distance where the project site contributes less than 15% of the upstream drainage basin area or 1,500 ft. downstream of the stormwater point of discharge, whichever is greater.

BASIN CHARACTERISTICS

Existing Conditions

The site is zoned Office Business Center (OBC) and is approximately 11.36 acres. The property is bordered by single family residential to the north, a park to the east, commercial development to the south, and a commercial business center to the west. The site slopes generally from north to south, is undeveloped, and is covered with grass, brush, volunteer trees, with a large grove of trees on the north side of the site.

Slopes on the site range between 12 and 17 percent. The site is underlain by shallow weathered bedrock and moisture sensitive soils with little to no infiltration.

Existing drainage flows north to south, ultimately flowing to the City's existing storm system along Tannler Drive or Blankenship Rd and into a culvert that flows underneath Interstate 205.

The following technical criteria were determined for the existing site:

- **Hydrologic Soil Group D (Per USGS WebSoil Survey)**
    - **78B – Saum Silt Loam, 3 to 8 percent slopes: 2.4% of Site Area, Soil Group C**
    - **78C – Saum Silt Loam, 8 to 15 percent slopes: 12.6% of Site Area, Soil Group C**
    - **89D – Witzel Very Stony Silt Loam: 85.0% of Site Area. Soil Group D**
- **Time of Concentration: 10 minutes**
- **Curve Number:**
    - **70 (Existing ground per West Linn Stormwater Management Manual 2.3.2.1)**

The vicinity map and existing basin map are available in Appendix A. Additional soil data is available in Appendix B. Infiltration as a method of stormwater management was not recommended by the geotechnical engineer (Columbia West) in an addendum to the geotechnical report dated January 27, 2026 "due to the presence of steep slopes at the site and subsurface conditions."

Refer to Appendix G for the geotechnical report and the addendum.

Proposed Conditions

The proposed development will consist of 320 units in ten multi-family residential buildings, garages, a clubhouse, accessory uses, and approximately 12,118 square feet of commercial mixed-use space on the ground floor. The proposed site grading and layout is tiered with parking lots serving buildings at different elevations moving down the hill from north to south. Each tier will collect stormwater utilizing catch basins and a network of underground storm pipes to convey stormwater to treatment vaults and underground detention before releasing to an existing storm main on the east side of Tannler Drive that flows north to south, thus the proposed condition generally maintains the flow characteristics of the existing site flowing north to south.

Stormwater facilities for the south portion of the site will release water to a new main in Tannler Drive that is proposed to flow south and connect to the existing stormwater main in Blankenship Road. A public system will collect stormwater from Tannler and Blankenship rights-of-way and pipe to a public stormwater planter facility located at the natural low point in the SE corner of the site within the public right-of-way of Blankenship. The release rate of all stormwater facilities will be regulated by flow control manholes to match the existing 2, 10, and 25-year, 24-hour storm events, meeting the City of West Linn criteria for large developments. All stormwater will ultimately drain into the existing city storm system as it leaves the site at the southeast corner of the development extents.

The existing and proposed impervious and pervious areas are outlined in Table 2 below. See Appendix A for pre-developed and post-developed basin maps.

Table 2. Impervious & Pervious Basin Areas

Basin	Pre-Development			Post-Development		
	Impervious (ac)	Pervious (ac)	Total (ac)	Impervious (ac)	Pervious (ac)	Total (ac)
A	0 (0.000)	77,258 (1.774)	77,258 (1.774)	40,023 (0.919)	37,235 (0.855)	77,258 (1.774)
B	0 (0.000)	126,737 (2.909)	126,737 (2.909)	72,652 (1.668)	54,085 (1.242)	126,737 (2.909)
C	0 (0.000)	55,842 (1.282)	55,842 (1.282)	44,926 (1.031)	10,916 (0.251)	55,842 (1.282)
D	0 (0.000)	95,094 (2.183)	95,094 (2.183)	72,428 (1.662)	22,666 (0.520)	95,094 (2.183)
E	36,316 (0.834)	34,650 (0.795)	70,966 (1.629)	52,854 (1.213)	18,112 (0.416)	70,966 (1.629)
F	9,620 (0.221)	33,859 (0.777)	43,479 (0.998)	36,082 (0.828)	7,397 (0.170)	43,479 (0.998)
G	0 (0.000)	19,198 (0.441)	19,378 (0.445)	17,831 (0.409)	1,547 (0.036)	19,378 (0.445)
H	12,257 (0.281)	2,516 (0.058)	14,773 (0.339)	12,740 (0.292)	2,033 (0.047)	14,773 (0.339)
PUBLIC	27,698 (0.636)	64,683 (1.485)	92,378 (2.121)	73,251 (1.682)	19,127 (0.439)	92,378 (2.121)

The following technical criteria were determined for the proposed site:

- **Time of Concentration (all basins): 6 minutes**
- **Curve Number:**
    - **98 (Proposed Impervious Area)**
    - **80 (Proposed Landscaping)**

The proposed basin map and storm plan sheets are available in Appendix A.

STORMWATER MANAGEMENT

Water Quality

The City of West Linn water quality requirements will be met by treating runoff using proprietary treatment vaults for the private site except for a small portion of Buildings 8 and 10, which will be treated by lined, vegetated planters. A lined, vegetated stormwater planter located at the lowest point in Blankenship Rd right-of-way will also be utilized for the public roadways. According to the City of West Linn Stormwater Management Manual, “manufactured stormwater treatment technology” is ranked third in the hierarchy of stormwater management facilities used to manage the water quality design storm, behind full or partial infiltration, and vegetated filtration or other green infrastructure. Per the geotechnical report (see Appendix G), infiltration is not recommended due to the site’s steep slopes and subsurface conditions. Vegetated filtration onsite is not feasible due to the site’s topography. The entire site is steep, and the proposed development will grade flatter areas onsite for its buildings and hardscape with retaining walls placed throughout the site, leaving only very steep terrain as options for placing a vegetated swale or pond. Placing a pond or swale on the steep slopes of the site would not provide adequate residence time for stormwater treatment and/or would require additional large walls to accommodate the cut section of a pond. Therefore, underground detention is proposed beneath the asphalt of the parking lots with upstream treatment provided by Contech StormFilter vaults.

The following City of West Linn Water Quality Design Storm was used for water quality calculations:

- **1 inch per 24-hour period**

Table 3 below provides a summary of the water quality calculations.

Table 3. Water Quality Calculation Summary – Private Onsite

Basin	Water Quality Flow (cfs)	Proposed Treatment Facility	Number of Cartridges*
A	0.19	Contech StormFilter 6' x 8' Peak Diversion Vault	5
B	0.34	Contech StormFilter 6' x 12' Peak Diversion Vault	9
C	0.21	Contech StormFilter 6' x 8' Peak Diversion Vault	5
D	0.34	Contech StormFilter 6' x 12' Peak Diversion Vault	9
E	0.25	Contech StormFilter 6' x 8' Peak Diversion Vault	6
F	0.17	Contech StormFilter 6' x 8' Peak Diversion Vault	5
G	0.08	Lined Planter	NA
H	0.06	Lined Planter	NA

*Calculations assume 27" PSORB cartridges with peak flow capacity of 0.042 cfs (18.79 gpm)

Basin G will utilize a lined, vegetated, walled stormwater planter facility located in the southeast corner of the site. The proposed storm planter has a 1,160 square-foot bottom area and is 2.0-feet-deep (includes 1 foot of freeboard). The planter will also have a 1,160 square-foot, 4.0-foot-deep drain rock storage section. Peak water quality design elevation is 0.04 feet above bottom of planter, and the facility overflow is set at 1.50 feet above bottom of planter, ensuring the required water quality design storm volume does not overflow and is infiltrated through the vegetated facility growing medium and into the perforated underdrain system.

Basin H will utilize a lined, vegetated walled stormwater planter facility located in the southwest corner of the site. The proposed storm planter has a 738 square-foot bottom area and is 2.0-feet-deep (includes 1 foot of freeboard). The planter will also have a 738 square-foot, 4.0-foot-deep drain rock storage section. Peak water quality design elevation is 0.06 feet above bottom of planter, and the facility overflow is set at 1.50 feet above bottom of planter, ensuring the required water quality design storm volume does not overflow and is infiltrated through the vegetated facility growing medium and into the perforated underdrain system.

Public right-of-way runoff for Tannler Dr and Blankenship Rd will be collected via catch basins and piped to a lined vegetated, walled stormwater planter facility located in the southeast corner of the site within the Blankenship right-of-way. The proposed storm planter has a 3,650 square-foot bottom area and is 2.0-feet-deep (includes 1 foot of freeboard). The planter will also have a 3,650 square-foot, 4.0-foot-deep drain rock storage section.

The water quality design storm of 1.00" depth for the required treatment area of all new/modified impervious area was routed through the HydroCAD model. A beehive control structure will be utilized within the facility. Peak water quality design elevation ranges from 0.04 to 0.14 feet above bottom of planter, and the facility overflows are set at 1.50 feet above bottom of planter, ensuring the required water quality design storm volume does not overflow and is infiltrated through the vegetated facility growing medium and into the perforated underdrain system.

Pollutants of concern related to commercial development and roadway construction include sediment, nutrients, pesticides, herbicides, fungicides, metals (zinc, copper, lead, etc.), oil, grease and other petroleum. These selected stormwater management best management practices (BMP) specifically target all pollutants of concern.

Refer to Appendix A for water quality basin map. Refer to Appendix C for hydrographs.

Flow Control

The project proposes to add 7.73 acres (336,896 SF) of impervious area to the site; therefore, it is classified as a 'large development' by the City of West Linn Stormwater Management Manual. Peak-flow matching is required for the pre-developed 2, 10, and 25-year, 24-hour storm events. The site layout lends itself to a 'centralized' approach with all stormwater on site being piped to a single centralized underground detention facility for each respective basin. The Santa Barbara Urban Hydrograph (SBUH) was chosen to demonstrate the detention facilities are adequately sized for flow control using the following parameters:

- **2-Year: 2.5 inches/hour**
- **10-Year: 3.45 inches/hour**
- **25-Year: 3.9 inches/hour**
- **100-Year: 4.74 inches/hour**
- **Type 1A Rainfall Distribution**

Site stormwater will be routed to R-Tank underground containment systems beneath each parking area. Flow out of each R-Tank system is regulated by a flow control manhole with a single orifice. A 12" overflow is provided to help convey the 10-, 25-, and 100-year storm events.

Proposed R-Tank facilities are designed to capture and detain runoff from onsite only. Runoff in the public right-of-way from Tannler and Blankenship will be captured via catch basins and piped to a public stormwater planter. Refer to the Conveyance section of this report for more information and refer to Appendix A for the proposed basin map.

Table 4 below provides a summary of the flow control data for the private onsite portion of this project and Table 5 provides a summary of the public offsite portion.

Table 4. Flow Control Data – Private Onsite

Storm Event	Pre-Developed Flow (cfs)	Post-Developed Flow (cfs)	Detained Release Rate (cfs)
2-Year	0.39	5.17	0.38
10-Year	1.74	7.66	1.31
25-Year	2.54	8.86	1.89
100-Year*	4.21	11.14	4.04

*100-year storm event not required for peak flow matching. Shown for conveyance through the R-Tank system only.

To mitigate the impacts of the new or reconstructed impervious areas within the public right-of-way, a walled filtration planter with a perforated underdrain and beehive control structure will be utilized to treat runoff and reduce the peak discharge of post-development stormwater flows.

Table 5. Flow Control Data – Public Offsite

Storm Event	Pre-Developed Flow (cfs)	Post-Developed Flow (cfs)	Detained Release Rate (cfs)
2-Year	0.071	1.034	0.070
10-Year	0.317	1.499	0.286
25-Year	0.462	1.723	0.418

Refer to Appendix D for hydrographs.

Conveyance

Stormwater pipes are designed per the City of West Linn Design Standards utilizing the Santa Barbara Urban Hydrograph Method (SBUH) to convey the 25-year storm event. Pipes were analyzed at critical locations depending on size, slope, and upstream basin size. Refer to Appendix E for conveyance calculations.

Emergency Overflow Route

In the event of facility failure, stormwater will be directed away from the proposed buildings and into the existing roadways where possible.

Downstream Analysis

A preliminary downstream analysis of the site has been performed per section 4.3 of the West Linn standards. The downstream analysis shall demonstrate adequate conveyance capacity to the distance where the project site contributes less than 15% of the upstream drainage basin area or 1,500 ft. downstream of the stormwater point of discharge, whichever is greater.

There are no identified downstream deficiencies. See Appendix F for additional information.

Construction Erosion Control

The construction erosion control requirements will meet City of West Linn and DEQ 1200-C requirements for grading and erosion control.

Operations and Maintenance

See Appendix H for a preliminary operations and maintenance plan for the R-Tank systems, Contech StormFilter structures, and public stormwater planter.

CONCLUSION

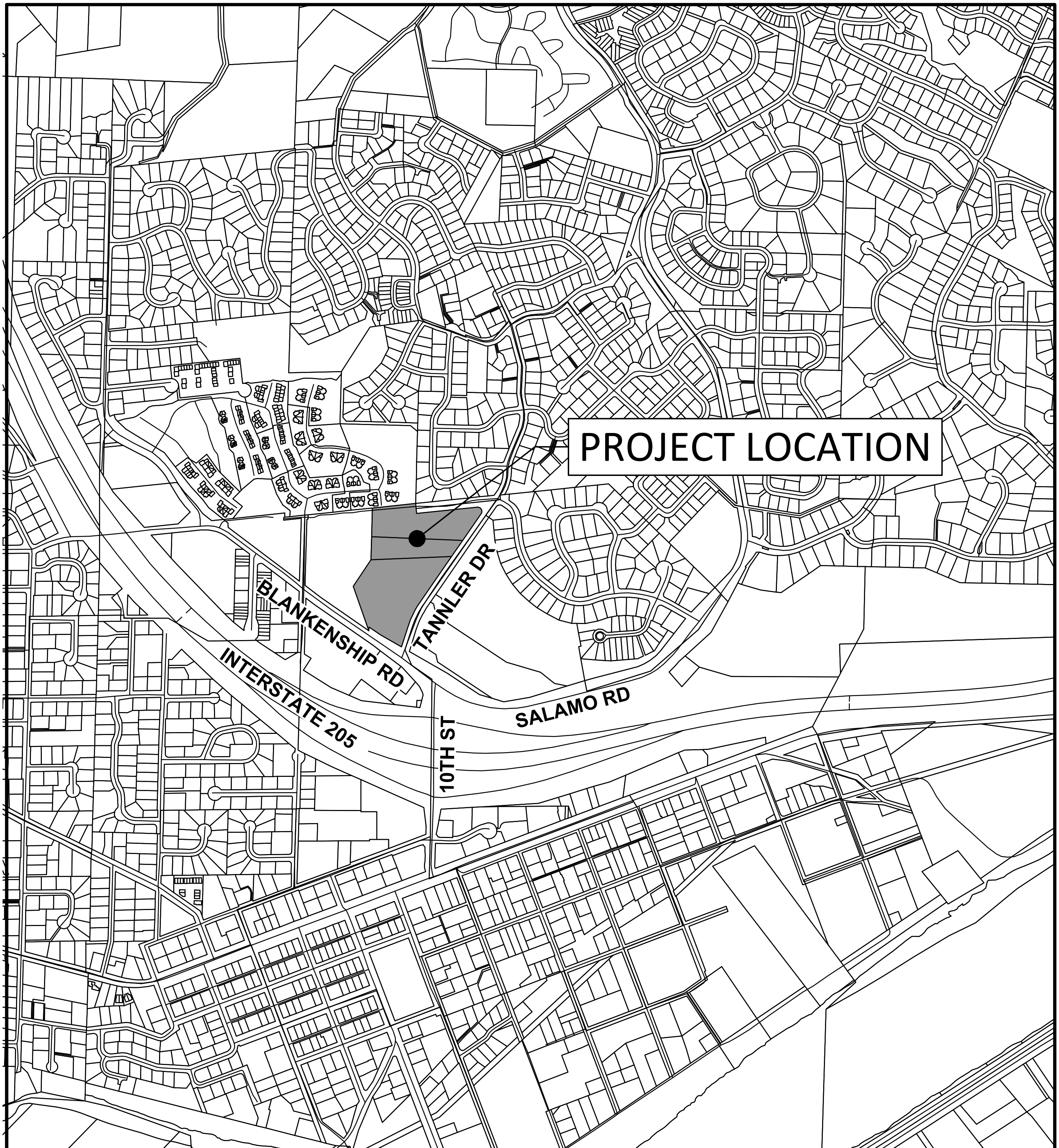
The proposed stormwater management plan will achieve stormwater quality and flow control to the standards of the City of West Linn Stormwater Management Manual dated May 2025.

REFERENCES

1. City of West Linn Stormwater Management Manual, May 2025.

APPENDIX A

MAPS AND PLANS



VICINITY MAP

SCALE: 1" = 1000'

SHEET NO.	REVISIONS	DESIGNED: HHPR
EX.1		DRAWN: HHPR
		CHECKED: HHPR
JOB NO. -----	R E V I S I O N S	DATE: FEB 2026

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VICINITY MAP

MODERA WEST LINN

WEST LINN, OREGON

P:\04-Salem\MCR (Mill Creek Residential Trust)\MCR-01 (Tannler Rd Multifamily)\MCR01-DOCS\Reports\Stormwater\CAD\ MCR01 - Pre Development Basin Map.dwg

LEGEND:

NEW/REPLACED IMPERVIOUS AREA

BASIN LIMITS

BASIN	IMPERVIOUS AREA (SQFT/ACRES)	PERVIOUS AREA (SQFT/ACRES)
PRE-DEV PRIVATE	58,193 (1.336)	450,035 (10.331)
PRE-DEV PUBLIC	27,698 (0.636)	64,683 (1.485)

PRE-DEVELOPMENT BASIN MAP

MODERA WEST LINN

WEST LINN, OREGON

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DATE: MAY 2026

DATE	NO.	DESCRIPTION

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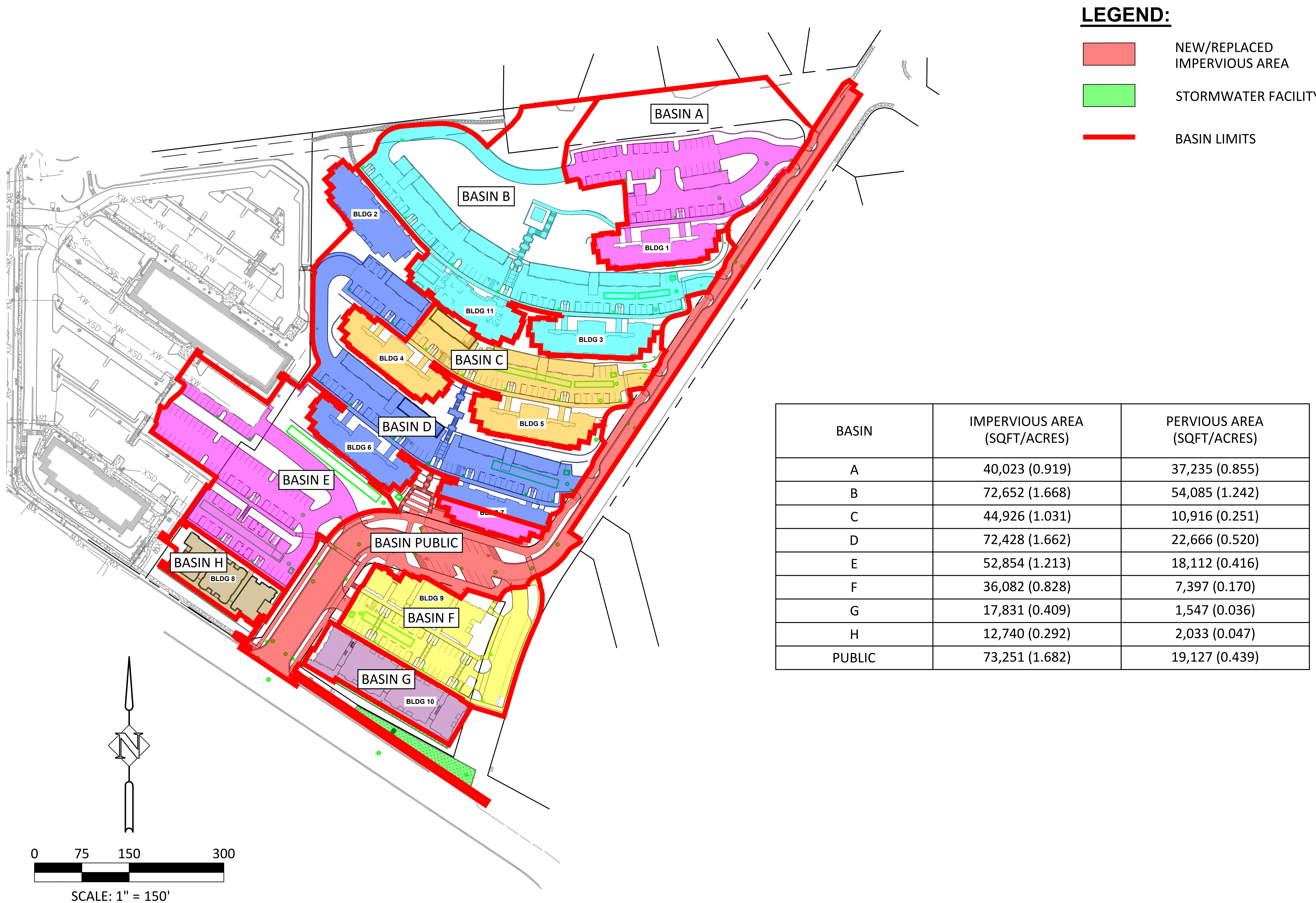
EX. 2

JOB NO. MCR-01

P:\04-Salem\MCR\MCR-01 (Tanner Rd Multifamily)\MCR01-DOCS\Reports\Stormwater\CAD\ MCR01 - Post Development Basin Map.dwg



BASIN	IMPERVIOUS AREA (SQFT/ACRES)	PERVIOUS AREA (SQFT/ACRES)
A	40,023 (0.919)	37,235 (0.855)
B	72,652 (1.668)	54,085 (1.242)
C	44,926 (1.031)	10,916 (0.251)
D	72,428 (1.662)	22,666 (0.520)
E	52,854 (1.213)	18,112 (0.416)
F	36,082 (0.828)	7,397 (0.170)
G	17,831 (0.409)	1,547 (0.036)
H	12,740 (0.292)	2,033 (0.047)
PUBLIC	73,251 (1.682)	19,127 (0.439)

POST-DEVELOPMENT BASIN MAP

MODERA WEST LINN

WEST LINN, OREGON

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EX. 3

JOB NO. MCR-01

APPENDIX B

SOIL DATA

Soil Map—Clackamas County Area, Oregon

Map Scale: 1:2,230 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 30, 60, 120, 180

Feet: 0, 100, 200, 400, 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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: Clackamas County Area, Oregon
Survey Area Data: Version 22, Sep 9, 2025

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

Date(s) aerial images were photographed: Mar 1, 2024—Jul 1, 2024

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
78B	Saum silt loam, 3 to 8 percent slopes	0.3	2.4%
78C	Saum silt loam, 8 to 15 percent slopes	1.7	12.6%
89D	Witzel very stony silt loam, 3 to 40 percent slopes	11.6	85.0%
Totals for Area of Interest		**13.6**	**100.0%**

Clackamas County Area, Oregon

89D—Witzel very stony silt loam, 3 to 40 percent slopes

Map Unit Setting

National map unit symbol: 227s
Elevation: 300 to 1,000 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Witzel and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Witzel

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve, nose slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium derived from basalt

Typical profile

H1 - 0 to 4 inches: very stony silt loam
H2 - 4 to 16 inches: very stony silty clay loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 40 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R002XC009OR - Bald Group
Forage suitability group: Well Drained > 15% Slopes (G002XY001OR)
Other vegetative classification: Well Drained > 15% Slopes (G002XY001OR)

Hydric soil rating: No

Data Source Information

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 22, Sep 9, 2025

Clackamas County Area, Oregon

78C—Saum silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2272
Elevation: 250 to 800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Saum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saum

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Material silty and colluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silty clay loam
H3 - 26 to 50 inches: gravelly silty clay loam
H4 - 50 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F002XB006OR - Foothill Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)

Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 22, Sep 9, 2025

Clackamas County Area, Oregon

78B—Saum silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2271
Elevation: 250 to 800 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Saum and similar soils: 80 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saum

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Material silty and colluvium

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 26 inches: silty clay loam
H3 - 26 to 50 inches: gravelly silty clay loam
H4 - 50 to 54 inches: unweathered bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F002XB006OR - Foothill Group
Forage suitability group: Well drained < 15% Slopes (G002XY002OR)

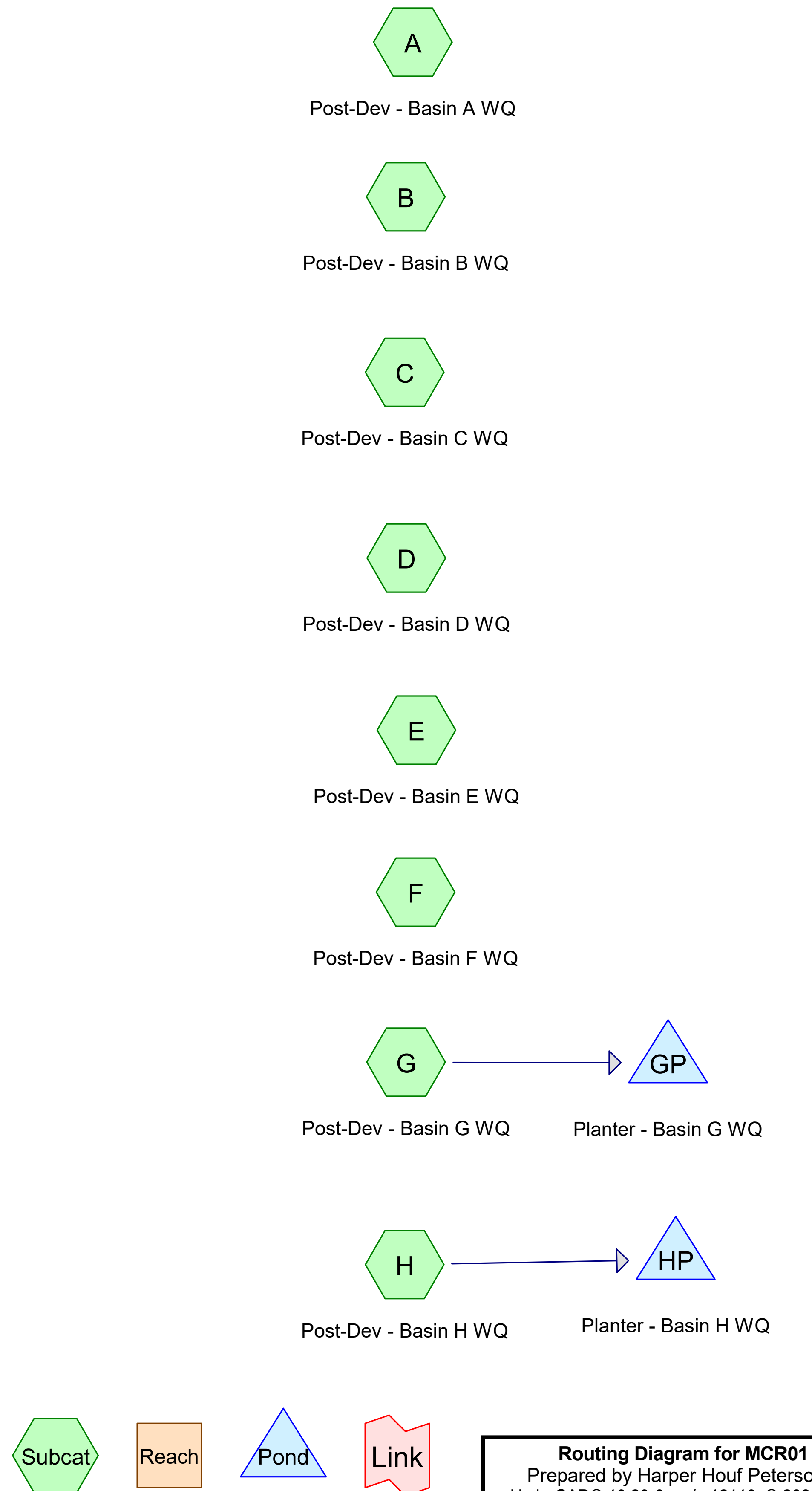
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 22, Sep 9, 2025

APPENDIX C

WATER QUALITY HYDROGRAPHS



Routing Diagram for MCR01 - Private HydroCAD - WQ
Prepared by Harper Houf Peterson Righells, Printed 5/22/2026

Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A: Post-Dev - Basin A WQ Runoff Area=40,023 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.19 cfs 0.061 af

Subcatchment B: Post-Dev - Basin B WQ Runoff Area=72,652 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.34 cfs 0.110 af

Subcatchment C: Post-Dev - Basin C WQ Runoff Area=44,926 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.21 cfs 0.068 af

Subcatchment D: Post-Dev - Basin D WQ Runoff Area=72,428 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.34 cfs 0.110 af

Subcatchment E: Post-Dev - Basin E WQ Runoff Area=52,854 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.25 cfs 0.080 af

Subcatchment F: Post-Dev - Basin F WQ Runoff Area=36,082 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.17 cfs 0.055 af

Subcatchment G: Post-Dev - Basin G WQ Runoff Area=17,831 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.08 cfs 0.027 af

Subcatchment H: Post-Dev - Basin H WQ Runoff Area=12,740 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.06 cfs 0.019 af

Pond GP: Planter - Basin G WQ Peak Elev=100.04' Storage=51 cf Inflow=0.08 cfs 0.027 af
Discarded=0.05 cfs 0.027 af Primary=0.00 cfs 0.000 af Outflow=0.05 cfs 0.027 af

Pond HP: Planter - Basin H WQ Peak Elev=100.06' Storage=45 cf Inflow=0.06 cfs 0.019 af
Discarded=0.03 cfs 0.019 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.019 af

Total Runoff Area = 8.024 ac Runoff Volume = 0.529 af Average Runoff Depth = 0.79"
0.00% Pervious = 0.000 ac 100.00% Impervious = 8.024 ac

Summary for Subcatchment A: Post-Dev - Basin A WQ

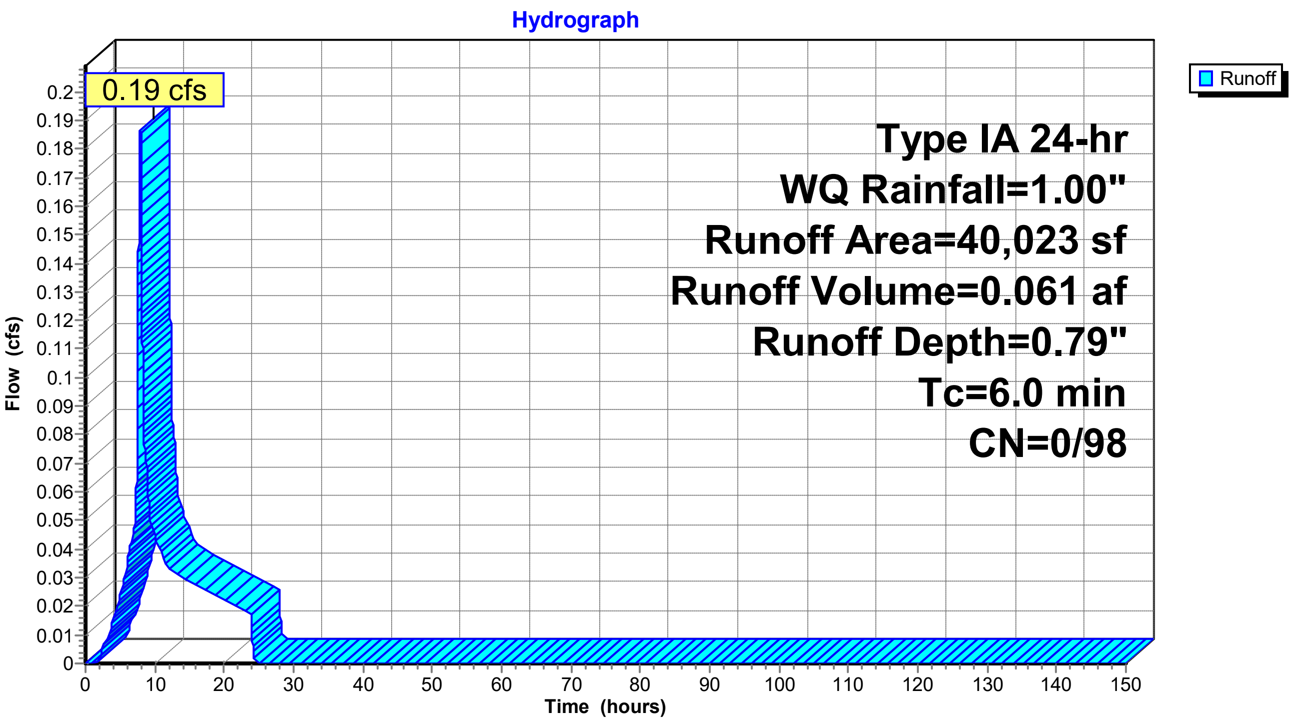
Runoff = 0.19 cfs @ 7.92 hrs, Volume= 0.061 af, Depth= 0.79"
Routed to nonexistent node AP

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	40,023	98	
	40,023	98	100.00% Impervious Area

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

Subcatchment A: Post-Dev - Basin A WQ



Summary for Subcatchment B: Post-Dev - Basin B WQ

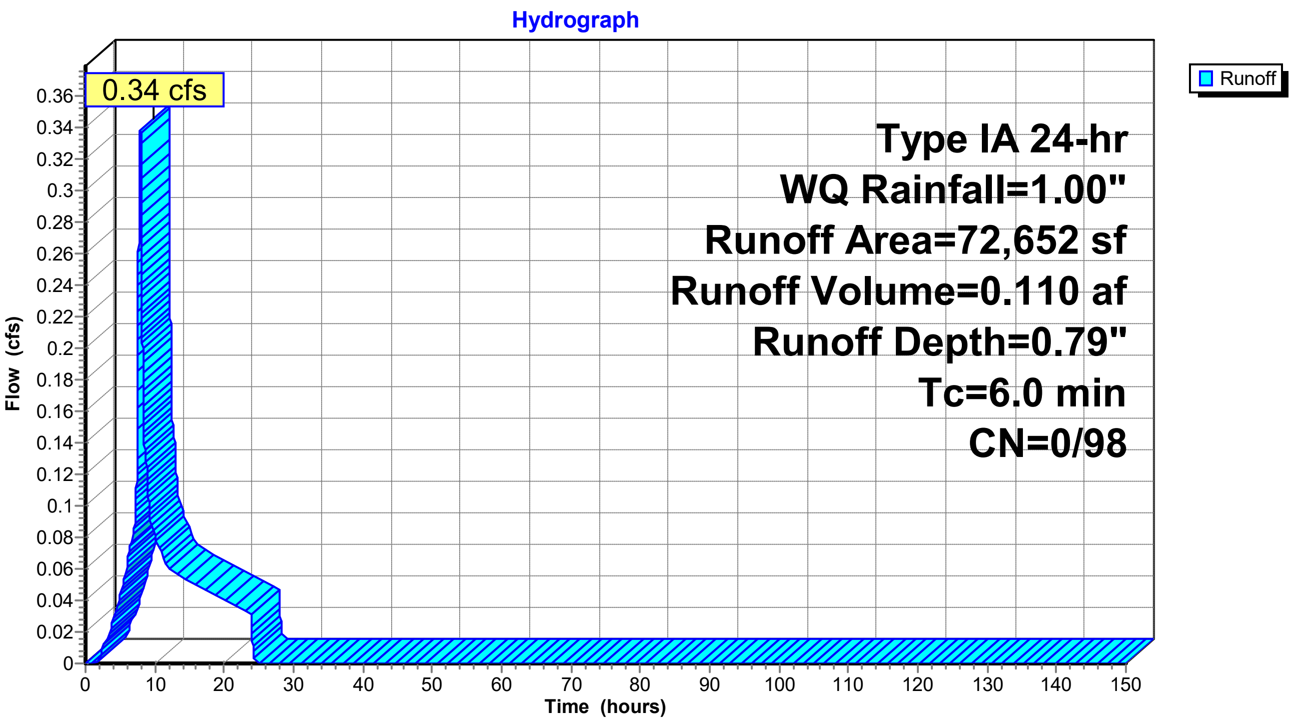
Runoff = 0.34 cfs @ 7.92 hrs, Volume= 0.110 af, Depth= 0.79"
Routed to nonexistent node BP

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	72,652	98	
	72,652	98	100.00% Impervious Area

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

Subcatchment B: Post-Dev - Basin B WQ



Summary for Subcatchment C: Post-Dev - Basin C WQ

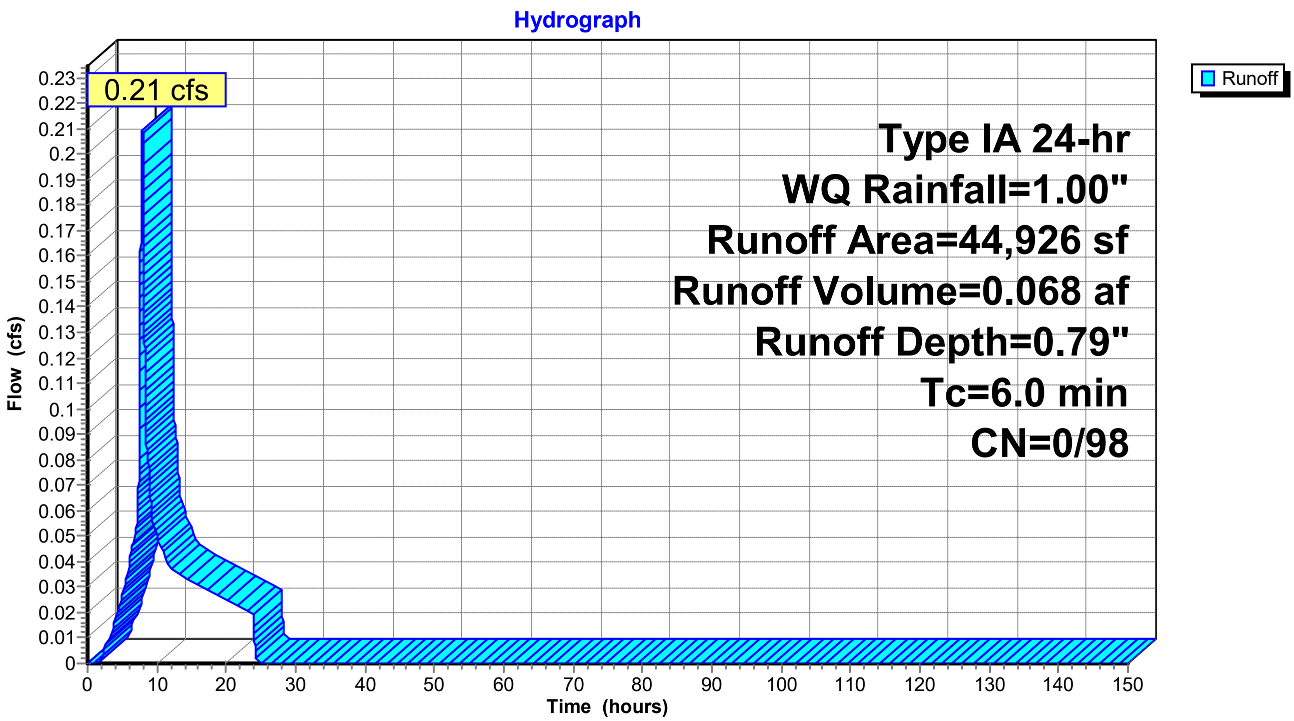
Runoff = 0.21 cfs @ 7.92 hrs, Volume= 0.068 af, Depth= 0.79"
Routed to nonexistent node CP

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	44,926	98	
	44,926	98	100.00% Impervious Area

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

Subcatchment C: Post-Dev - Basin C WQ



Summary for Subcatchment D: Post-Dev - Basin D WQ

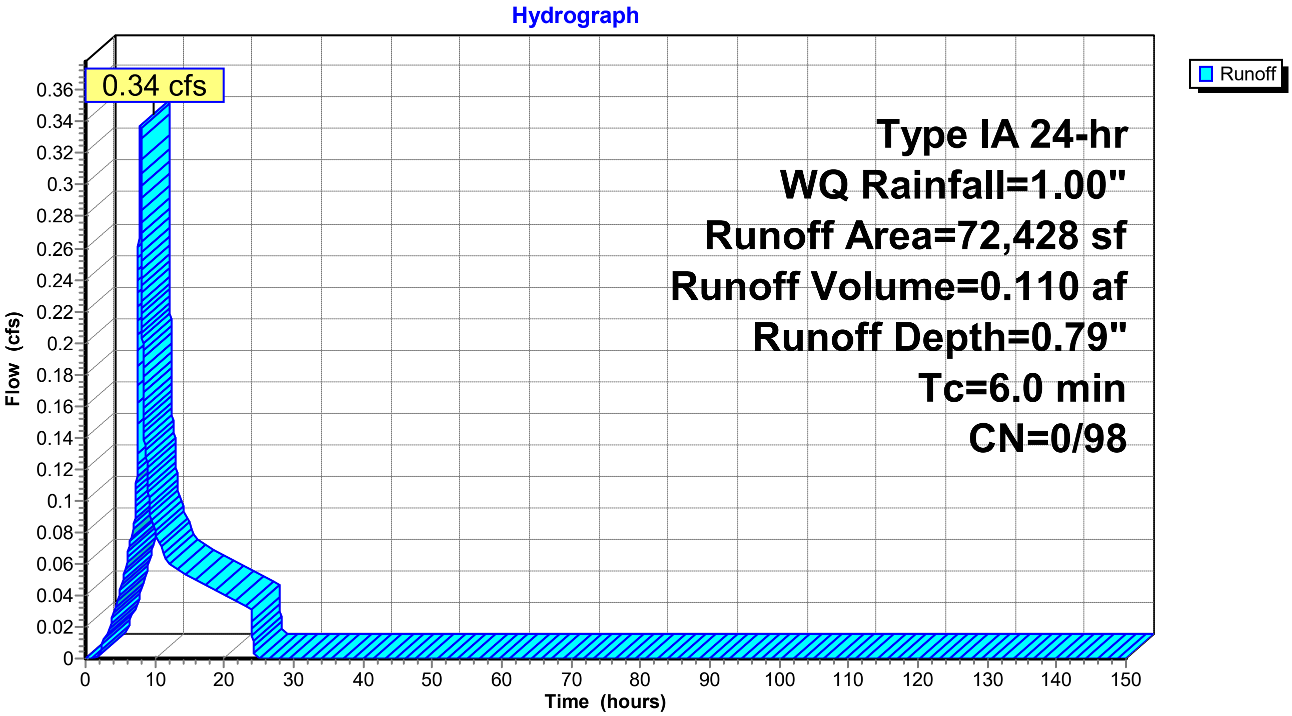
Runoff = 0.34 cfs @ 7.92 hrs, Volume= 0.110 af, Depth= 0.79"
Routed to nonexistent node DP

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	72,428	98	
	72,428	98	100.00% Impervious Area

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

Subcatchment D: Post-Dev - Basin D WQ



Summary for Subcatchment E: Post-Dev - Basin E WQ

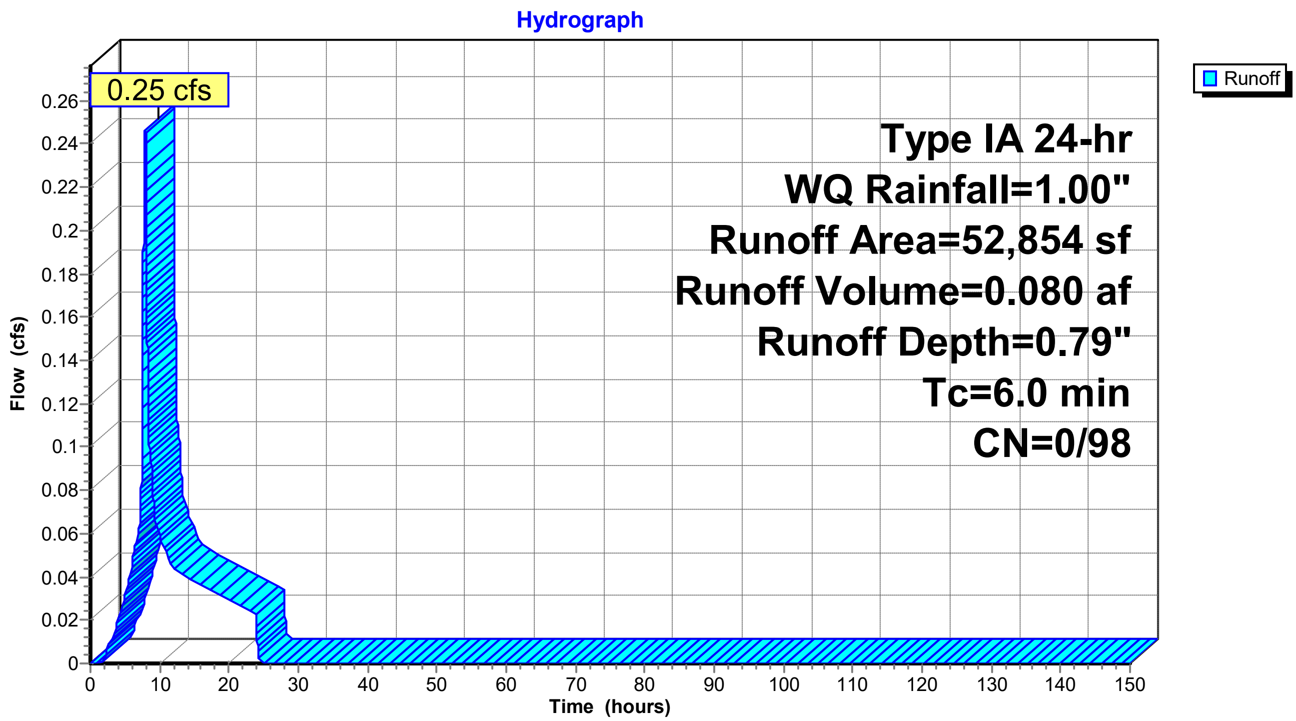
Runoff = 0.25 cfs @ 7.92 hrs, Volume= 0.080 af, Depth= 0.79"
Routed to nonexistent node EP

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	52,854	98	
	52,854	98	100.00% Impervious Area

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

Subcatchment E: Post-Dev - Basin E WQ



Summary for Subcatchment F: Post-Dev - Basin F WQ

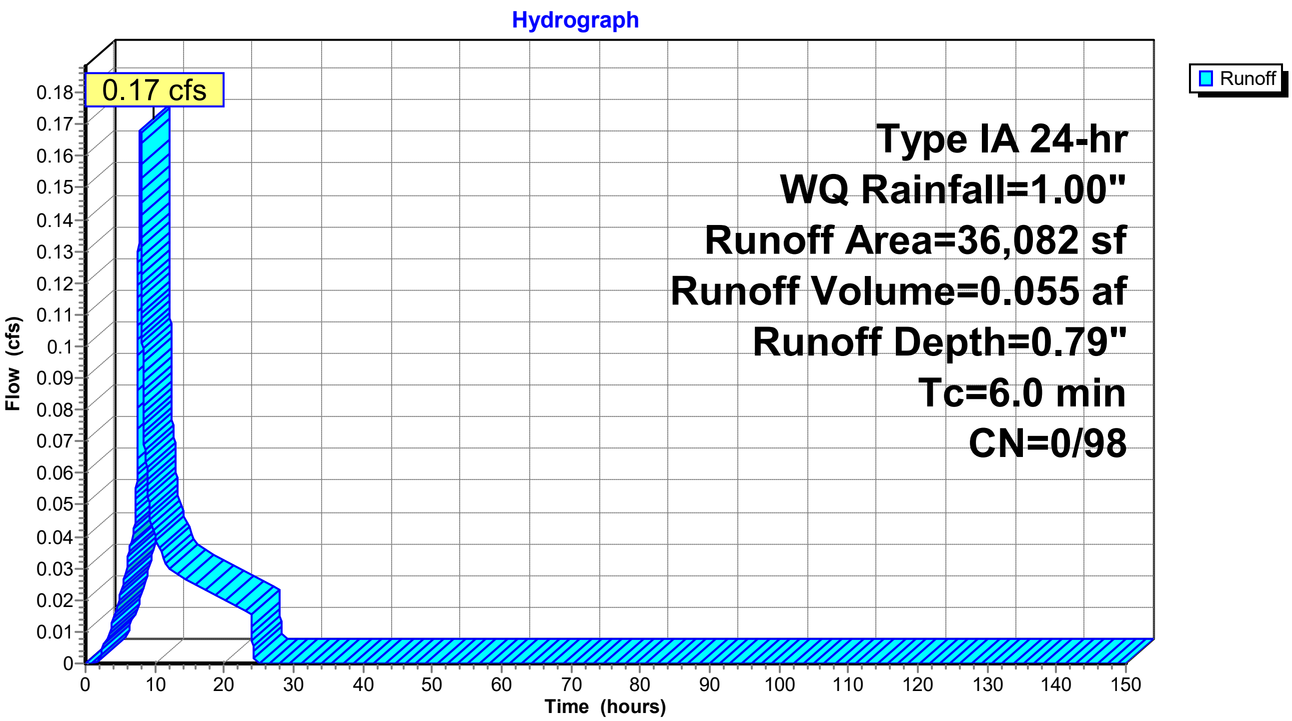
Runoff = 0.17 cfs @ 7.92 hrs, Volume= 0.055 af, Depth= 0.79"
Routed to nonexistent node FP

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	36,082	98	
	36,082	98	100.00% Impervious Area

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

Subcatchment F: Post-Dev - Basin F WQ



Summary for Subcatchment G: Post-Dev - Basin G WQ

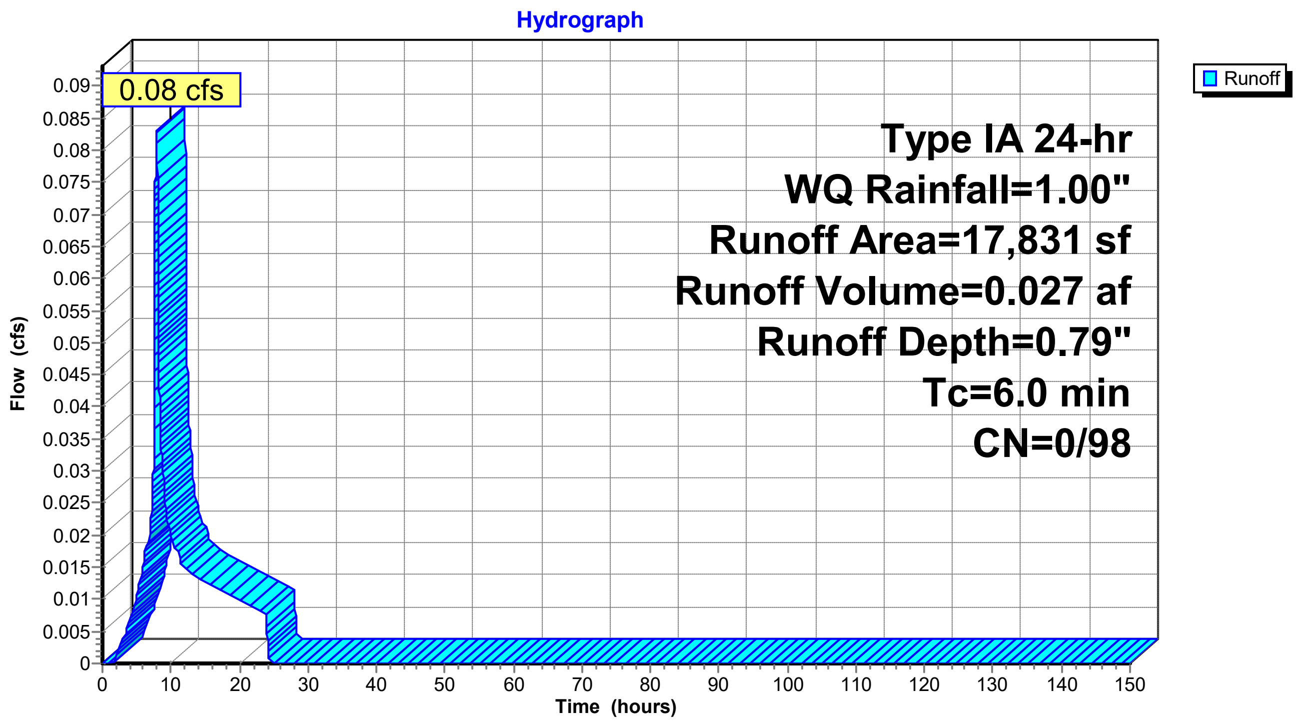
Runoff = 0.08 cfs @ 7.92 hrs, Volume= 0.027 af, Depth= 0.79"
Routed to Pond GP : Planter - Basin G WQ

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	17,831	98	
	17,831	98	100.00% Impervious Area

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

Subcatchment G: Post-Dev - Basin G WQ



Summary for Subcatchment H: Post-Dev - Basin H WQ

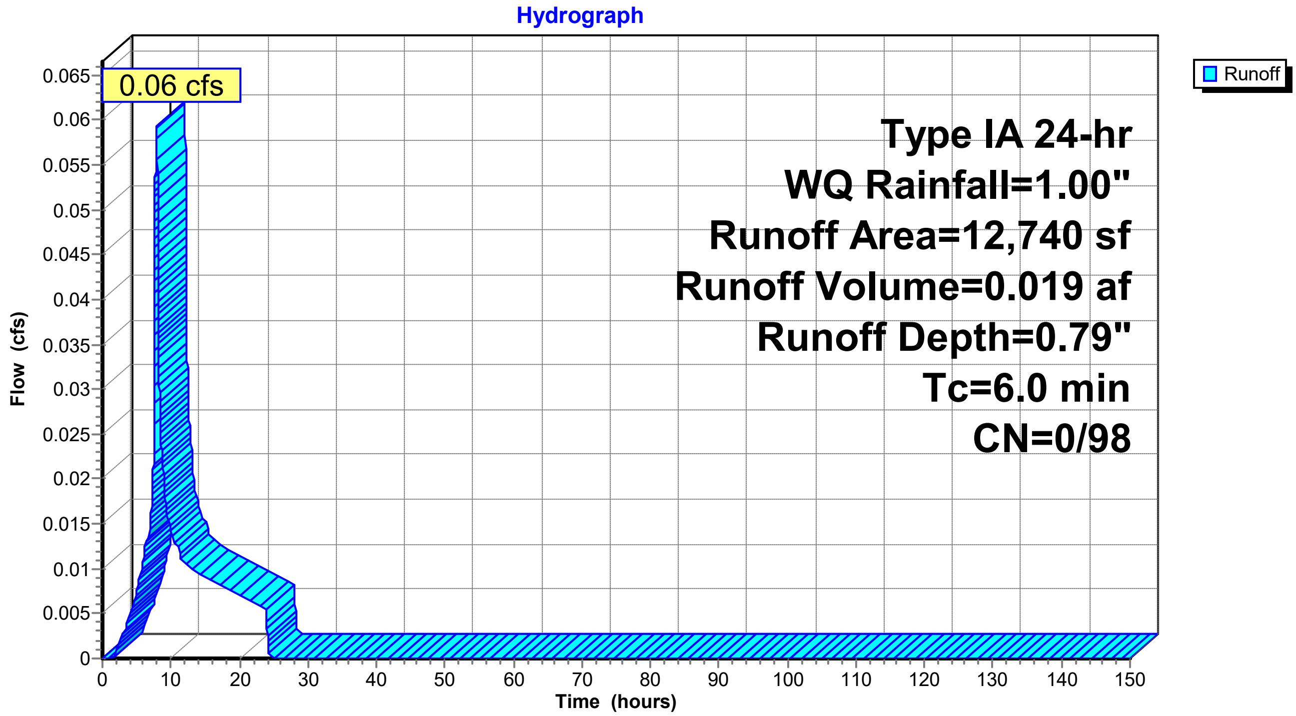
Runoff = 0.06 cfs @ 7.92 hrs, Volume= 0.019 af, Depth= 0.79"
Routed to Pond HP : Planter - Basin H WQ

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	12,740	98	
	12,740	98	100.00% Impervious Area

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

Subcatchment H: Post-Dev - Basin H WQ



Summary for Pond GP: Planter - Basin G WQ

Inflow Area = 0.409 ac,100.00% Impervious, Inflow Depth = 0.79" for WQ event
Inflow = 0.08 cfs @ 7.92 hrs, Volume= 0.027 af
Outflow = 0.05 cfs @ 7.81 hrs, Volume= 0.027 af, Atten= 35%, Lag= 0.0 min
Discarded = 0.05 cfs @ 7.81 hrs, Volume= 0.027 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node PR

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.04' @ 8.18 hrs Surf.Area= 1,160 sf Storage= 51 cf

Plug-Flow detention time= 5.0 min calculated for 0.027 af (100% of inflow)
Center-of-Mass det. time= 5.0 min (718.6 - 713.6)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	2,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

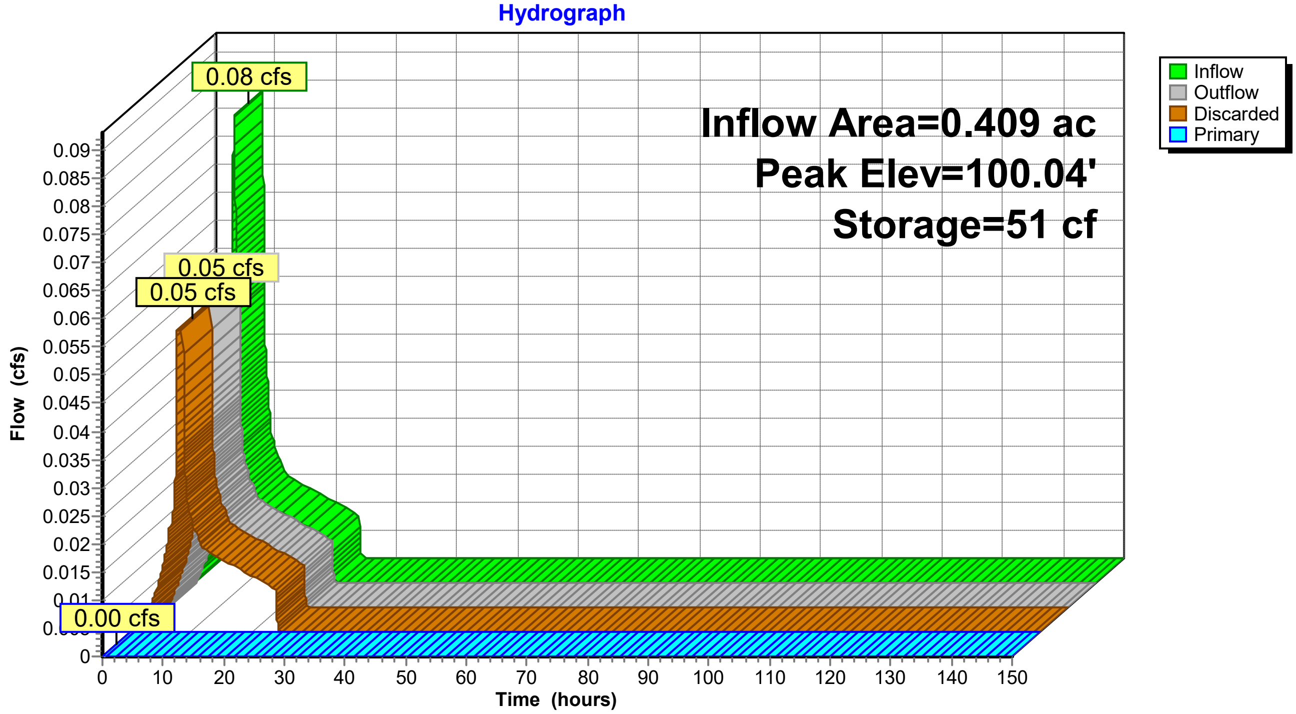
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	1,160	0	0
102.00	1,160	2,320	2,320

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Discarded	100.00'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.05 cfs @ 7.81 hrs HW=100.02' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=100.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 15.02 cfs potential flow)
  └─**2=Beehive OF** (Controls 0.00 cfs)

Pond GP: Planter - Basin G WQ



Summary for Pond HP: Planter - Basin H WQ

Inflow Area = 0.292 ac,100.00% Impervious, Inflow Depth = 0.79" for WQ event
Inflow = 0.06 cfs @ 7.92 hrs, Volume= 0.019 af
Outflow = 0.03 cfs @ 7.75 hrs, Volume= 0.019 af, Atten= 42%, Lag= 0.0 min
Discarded = 0.03 cfs @ 7.75 hrs, Volume= 0.019 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node PR

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.06' @ 8.24 hrs Surf.Area= 738 sf Storage= 45 cf

Plug-Flow detention time= 6.1 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 6.1 min (719.8 - 713.6)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,476 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

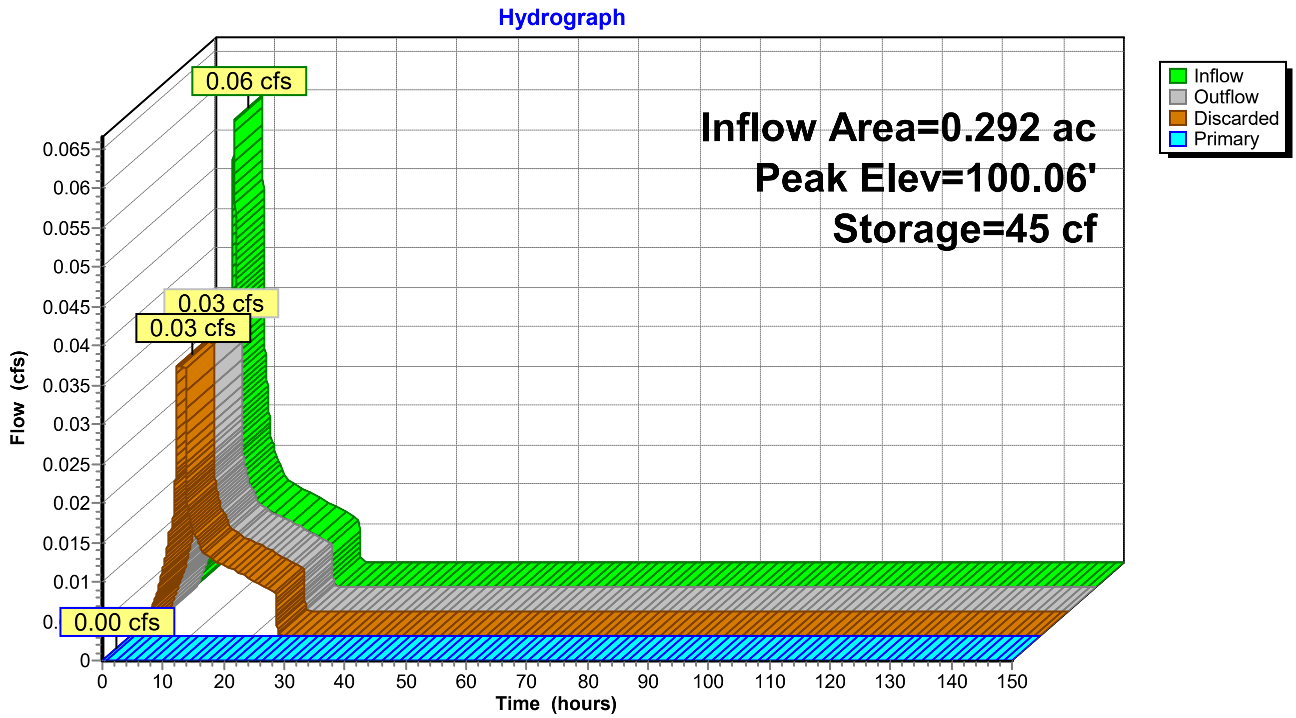
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	738	0	0
102.00	738	1,476	1,476

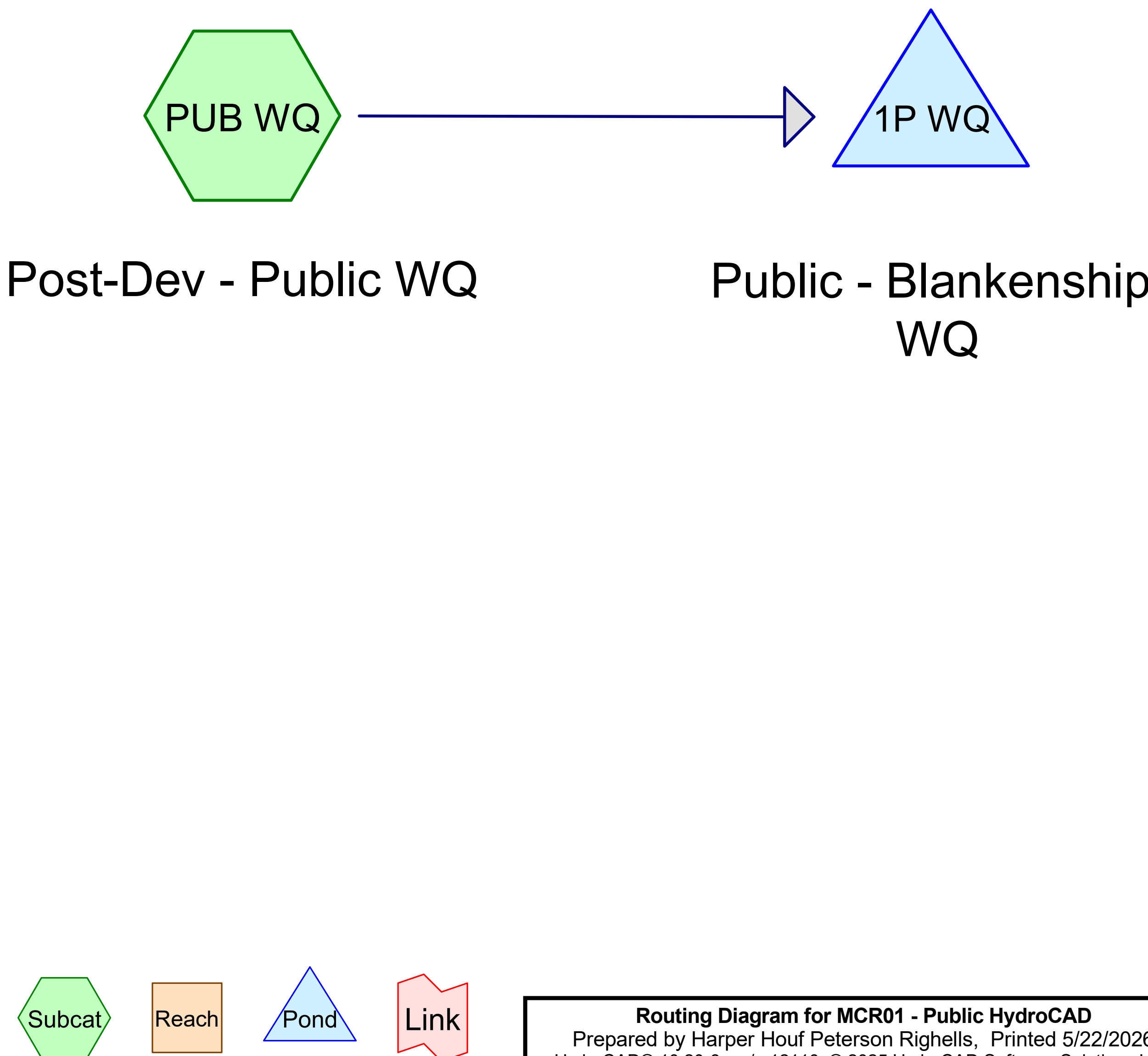
Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Discarded	100.00'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.03 cfs @ 7.75 hrs HW=100.02' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=100.00' (Free Discharge)
└─**1=Culvert** (Passes 0.00 cfs of 15.02 cfs potential flow)
  └─**2=Beehive OF** (Controls 0.00 cfs)

Pond HP: Planter - Basin H WQ





Routing Diagram for MCR01 - Public HydroCAD
Prepared by Harper Houf Peterson Righells, Printed 5/22/2026
HydroCAD® 10.20-8a s/n 12110 © 2025 HydroCAD Software Solutions LLC

Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PUB WQ: Post-Dev - Runoff Area=73,251 sf 100.00% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=0/98 Runoff=0.341 cfs 0.111 af

Pond 1P WQ: Public - Blankenship WQ Peak Elev=100.14' Storage=420 cf Inflow=0.341 cfs 0.111 af
Discarded=0.139 cfs 0.111 af Primary=0.000 cfs 0.000 af Outflow=0.139 cfs 0.111 af

Total Runoff Area = 1.682 ac Runoff Volume = 0.111 af Average Runoff Depth = 0.79"
0.00% Pervious = 0.000 ac 100.00% Impervious = 1.682 ac

Summary for Subcatchment PUB WQ: Post-Dev - Public WQ

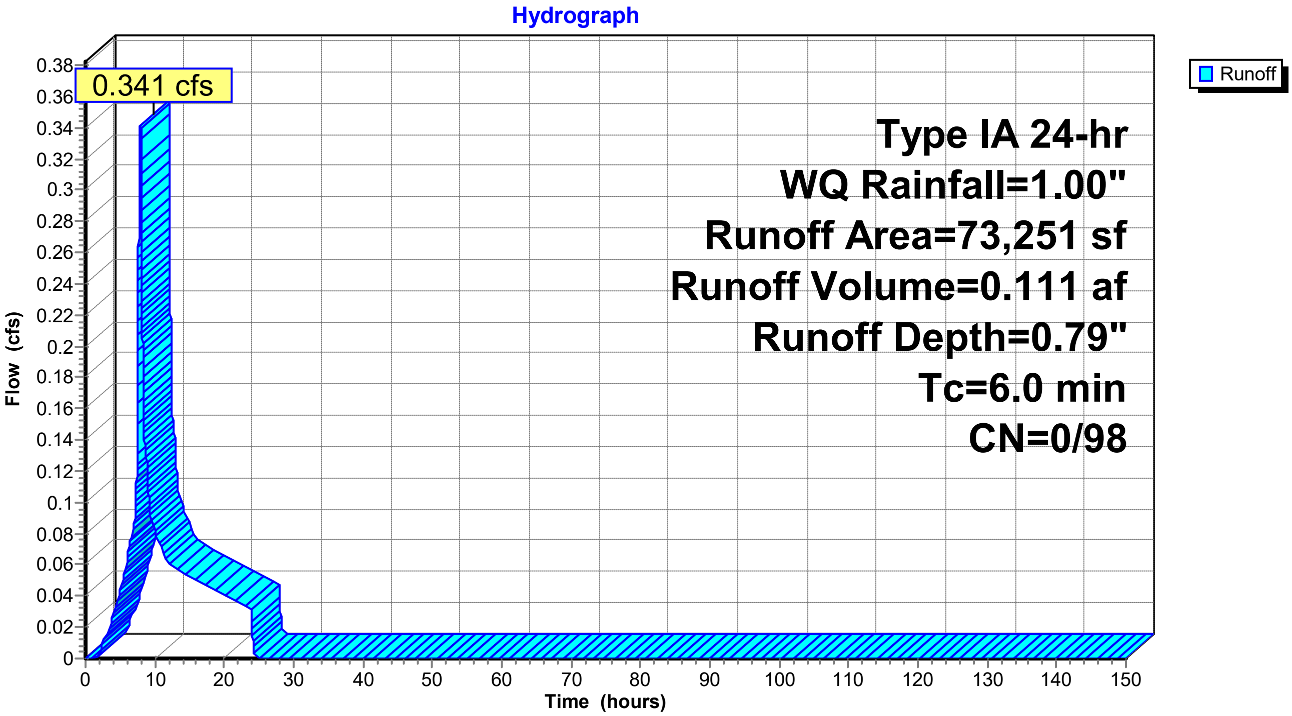
Runoff = 0.341 cfs @ 7.92 hrs, Volume= 0.111 af, Depth= 0.79"
Routed to Pond 1P WQ : Public - Blankenship WQ

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.00"

	Area (sf)	CN	Description
*	73,251	98	
	73,251	98	100.00% Impervious Area

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

Subcatchment PUB WQ: Post-Dev - Public WQ



Summary for Pond 1P WQ: Public - Blankenship WQ

Inflow Area = 1.682 ac,100.00% Impervious, Inflow Depth = 0.79" for WQ event
Inflow = 0.341 cfs @ 7.92 hrs, Volume= 0.111 af
Outflow = 0.139 cfs @ 7.65 hrs, Volume= 0.111 af, Atten= 59%, Lag= 0.0 min
Discarded = 0.139 cfs @ 7.65 hrs, Volume= 0.111 af
Primary = 0.000 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to nonexistent node 1L

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.14' @ 8.49 hrs Surf.Area= 3,008 sf Storage= 420 cf

Plug-Flow detention time= 13.6 min calculated for 0.111 af (100% of inflow)
Center-of-Mass det. time= 13.6 min (727.2 - 713.6)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	6,016 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

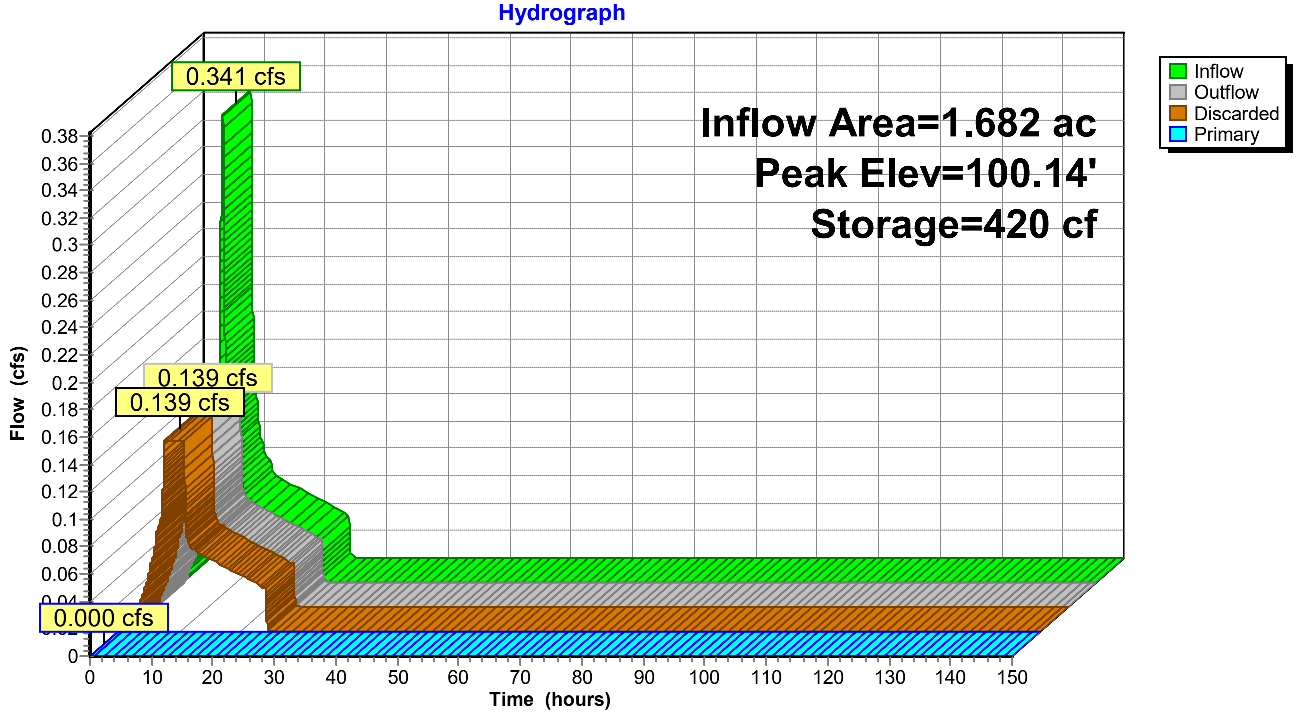
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	3,008	0	0
102.00	3,008	6,016	6,016

Device	Routing	Invert	Outlet Devices
#1	Primary	96.45'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 96.45' / 96.35' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Discarded	100.00'	**2.000 in/hr Exfiltration over Surface area** Phase-In= 0.01'

Discarded OutFlow Max=0.139 cfs @ 7.65 hrs HW=100.02' (Free Discharge)
└─**3=Exfiltration** (Exfiltration Controls 0.139 cfs)

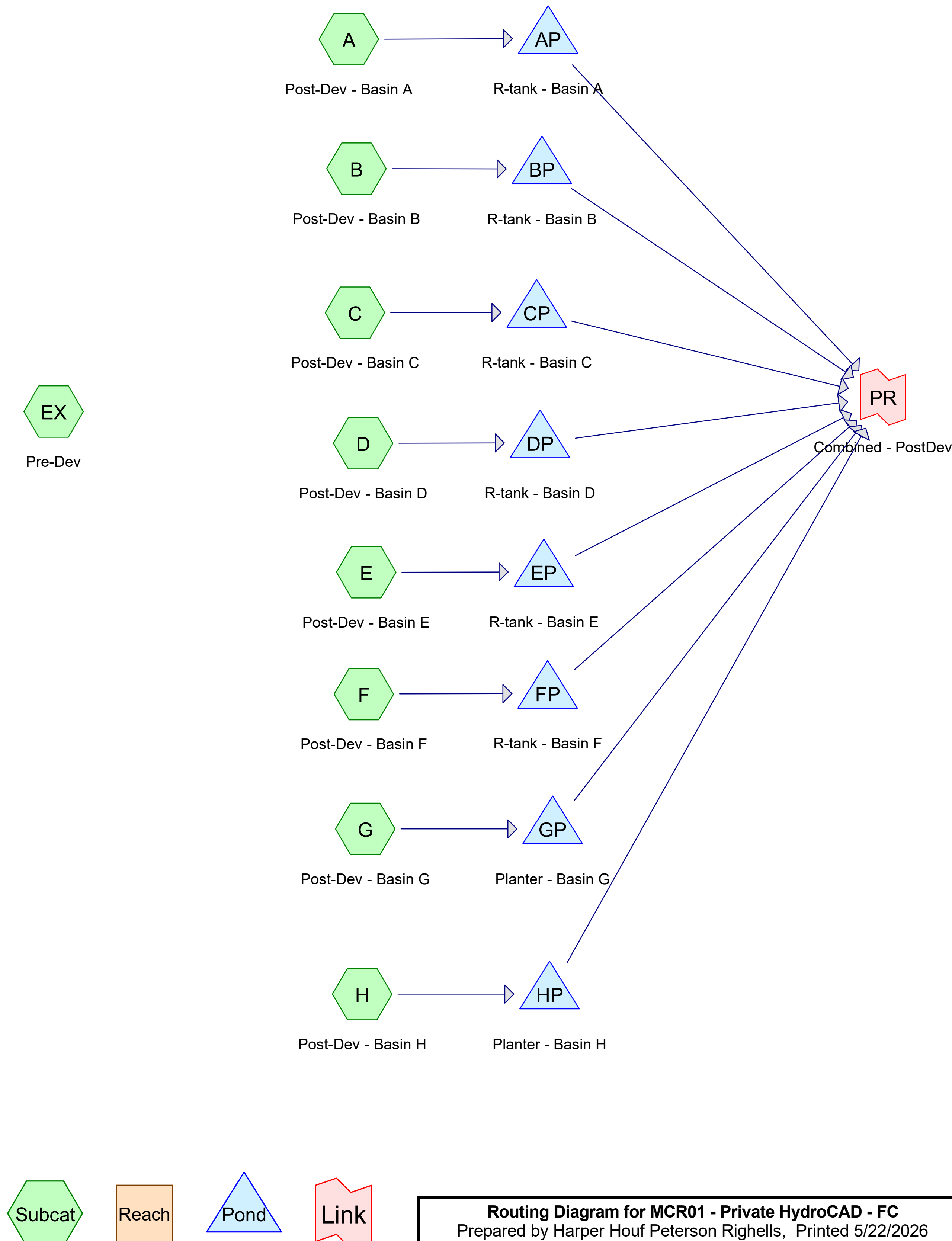
Primary OutFlow Max=0.000 cfs @ 0.00 hrs HW=100.00' (Free Discharge)
└─**1=Culvert** (Passes 0.000 cfs of 11.240 cfs potential flow)
  └─**2=Beehive OF** (Controls 0.000 cfs)

Pond 1P WQ: Public - Blankenship WQ



APPENDIX D

FLOW CONTROL HYDROGRAPHS



Routing Diagram for MCR01 - Private HydroCAD - FC
Prepared by Harper Houf Peterson Righells, Printed 5/22/2026
HydroCAD® 10.20-8a s/n 12110 © 2025 HydroCAD Software Solutions LLC

Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A: Post-Dev - Basin A	Runoff Area=77,258 sf 51.80% Impervious Runoff Depth=1.60" Tc=6.0 min CN=80/98 Runoff=0.67 cfs 0.237 af
Subcatchment B: Post-Dev - Basin B	Runoff Area=126,737 sf 57.33% Impervious Runoff Depth=1.68" Tc=6.0 min CN=80/98 Runoff=1.16 cfs 0.408 af
Subcatchment C: Post-Dev - Basin C	Runoff Area=55,842 sf 80.45% Impervious Runoff Depth=2.00" Tc=6.0 min CN=80/98 Runoff=0.63 cfs 0.214 af
Subcatchment D: Post-Dev - Basin D	Runoff Area=95,094 sf 76.16% Impervious Runoff Depth=1.94" Tc=6.0 min CN=80/98 Runoff=1.04 cfs 0.353 af
Subcatchment E: Post-Dev - Basin E	Runoff Area=70,966 sf 74.48% Impervious Runoff Depth=1.92" Tc=6.0 min CN=80/98 Runoff=0.76 cfs 0.260 af
Subcatchment EX: Pre-Dev	Runoff Area=508,228 sf 0.00% Impervious Runoff Depth=0.46" Tc=10.0 min CN=70/0 Runoff=0.39 cfs 0.443 af
Subcatchment F: Post-Dev - Basin F	Runoff Area=43,479 sf 82.99% Impervious Runoff Depth=2.04" Tc=6.0 min CN=80/98 Runoff=0.50 cfs 0.169 af
Subcatchment G: Post-Dev - Basin G	Runoff Area=19,378 sf 92.02% Impervious Runoff Depth=2.16" Tc=6.0 min CN=80/98 Runoff=0.24 cfs 0.080 af
Subcatchment H: Post-Dev - Basin H	Runoff Area=14,773 sf 86.24% Impervious Runoff Depth=2.08" Tc=6.0 min CN=80/98 Runoff=0.17 cfs 0.059 af
Pond AP: R-tank - Basin A	Peak Elev=105.97' Storage=0.152 af Inflow=0.67 cfs 0.237 af Outflow=0.06 cfs 0.234 af
Pond BP: R-tank - Basin B	Peak Elev=105.95' Storage=0.287 af Inflow=1.16 cfs 0.408 af Outflow=0.09 cfs 0.401 af
Pond CP: R-tank - Basin C	Peak Elev=105.97' Storage=0.159 af Inflow=0.63 cfs 0.214 af Outflow=0.04 cfs 0.210 af
Pond DP: R-tank - Basin D	Peak Elev=105.92' Storage=0.269 af Inflow=1.04 cfs 0.353 af Outflow=0.06 cfs 0.347 af
Pond EP: R-tank - Basin E	Peak Elev=106.01' Storage=0.228 af Inflow=0.76 cfs 0.260 af Outflow=0.07 cfs 0.208 af
Pond FP: R-tank - Basin F	Peak Elev=105.79' Storage=0.128 af Inflow=0.50 cfs 0.169 af Outflow=0.03 cfs 0.166 af
Pond GP: Planter - Basin G	Peak Elev=100.84' Storage=2,834 cf Inflow=0.24 cfs 0.080 af Outflow=0.01 cfs 0.078 af

Pond HP: Planter - Basin H Peak Elev=100.96' Storage=1,889 cf Inflow=0.17 cfs 0.059 af
Outflow=0.01 cfs 0.059 af

Link PR: Combined - PostDev Inflow=0.38 cfs 1.704 af
Primary=0.38 cfs 1.704 af

Total Runoff Area = 23.227 ac Runoff Volume = 2.223 af Average Runoff Depth = 1.15"
65.45% Pervious = 15.202 ac 34.55% Impervious = 8.024 ac

Summary for Subcatchment A: Post-Dev - Basin A

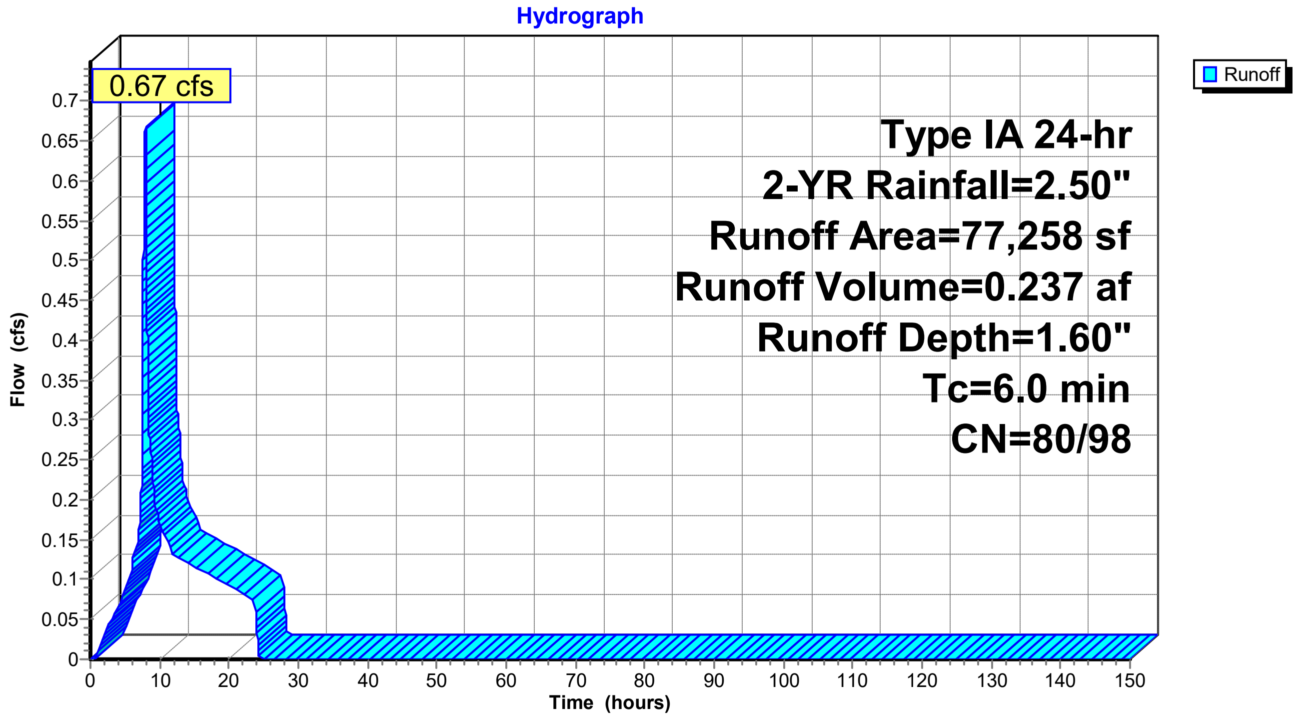
Runoff = 0.67 cfs @ 7.94 hrs, Volume= 0.237 af, Depth= 1.60"
Routed to Pond AP : R-tank - Basin A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	40,023	98	
*	37,235	80	
	77,258	89	Weighted Average
	37,235	80	48.20% Pervious Area
	40,023	98	51.80% Impervious Area

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

Subcatchment A: Post-Dev - Basin A



Summary for Subcatchment B: Post-Dev - Basin B

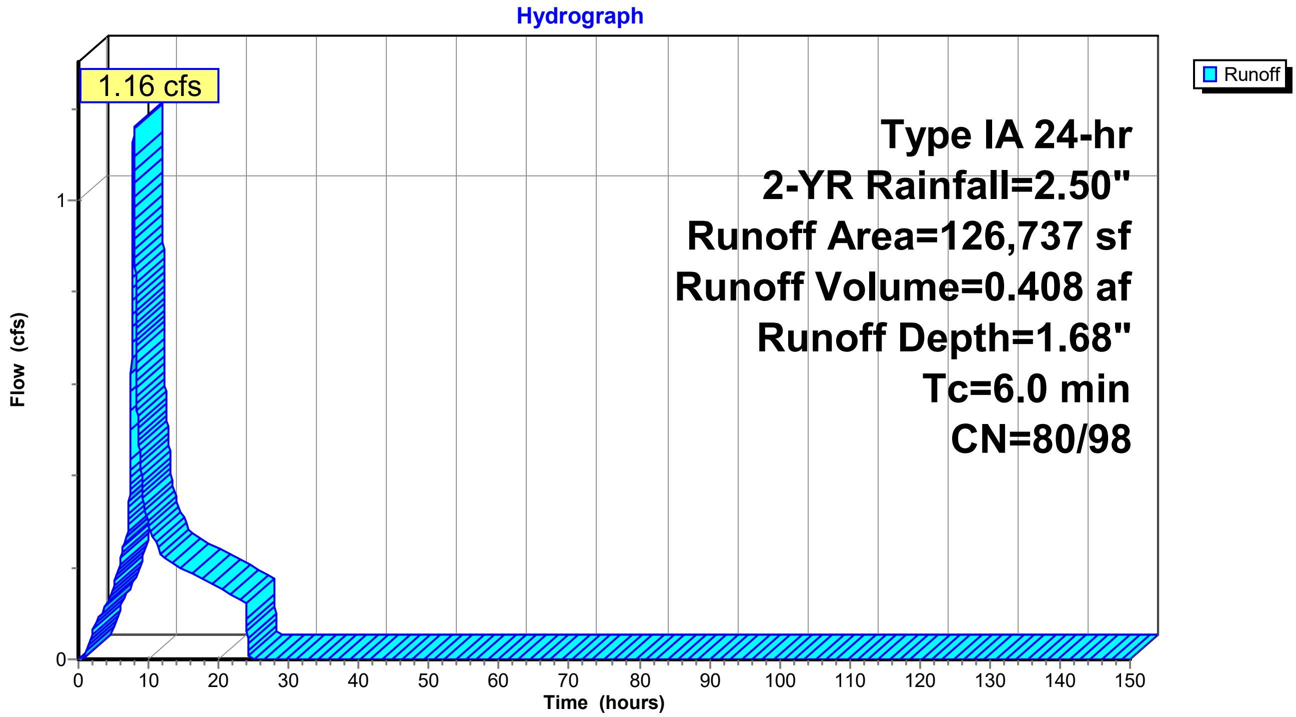
Runoff = 1.16 cfs @ 7.93 hrs, Volume= 0.408 af, Depth= 1.68"
Routed to Pond BP : R-tank - Basin B

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	72,652	98	
*	54,085	80	
	126,737	90	Weighted Average
	54,085	80	42.67% Pervious Area
	72,652	98	57.33% Impervious Area

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

Subcatchment B: Post-Dev - Basin B



Summary for Subcatchment C: Post-Dev - Basin C

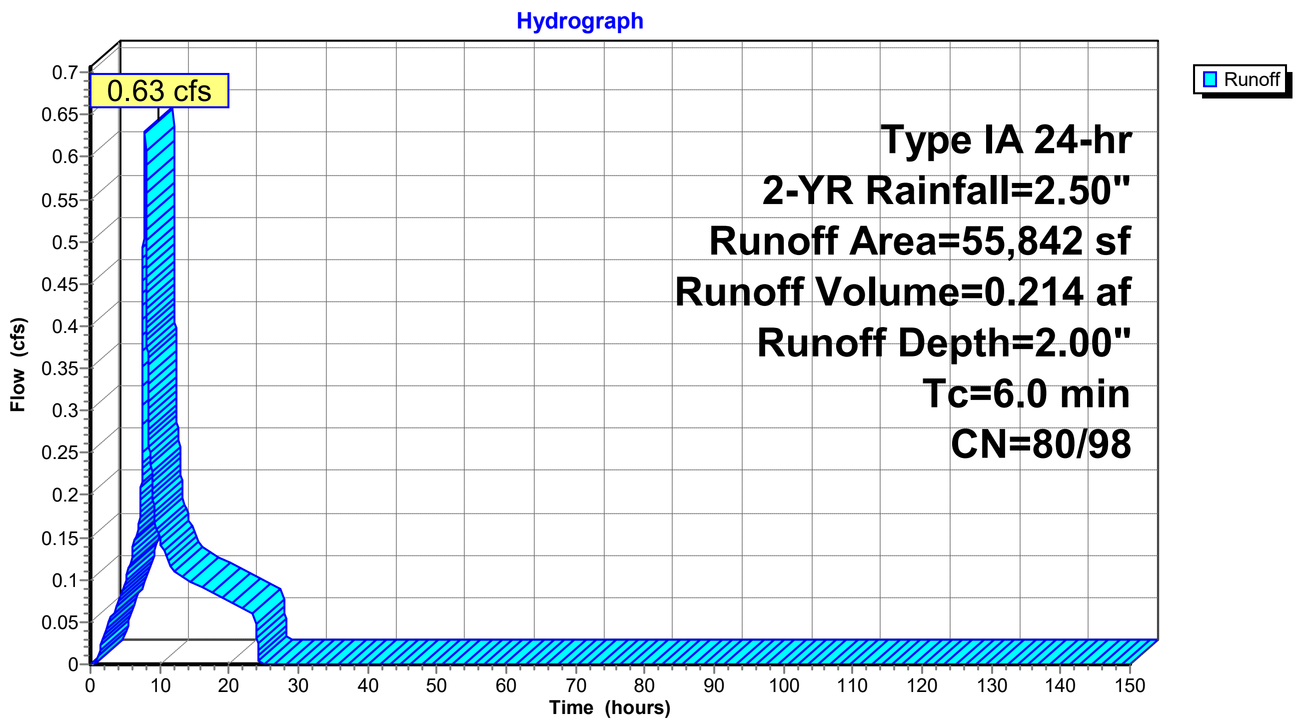
Runoff = 0.63 cfs @ 7.91 hrs, Volume= 0.214 af, Depth= 2.00"
Routed to Pond CP : R-tank - Basin C

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	44,926	98	
*	10,916	80	
	55,842	94	Weighted Average
	10,916	80	19.55% Pervious Area
	44,926	98	80.45% Impervious Area

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

Subcatchment C: Post-Dev - Basin C



Summary for Subcatchment D: Post-Dev - Basin D

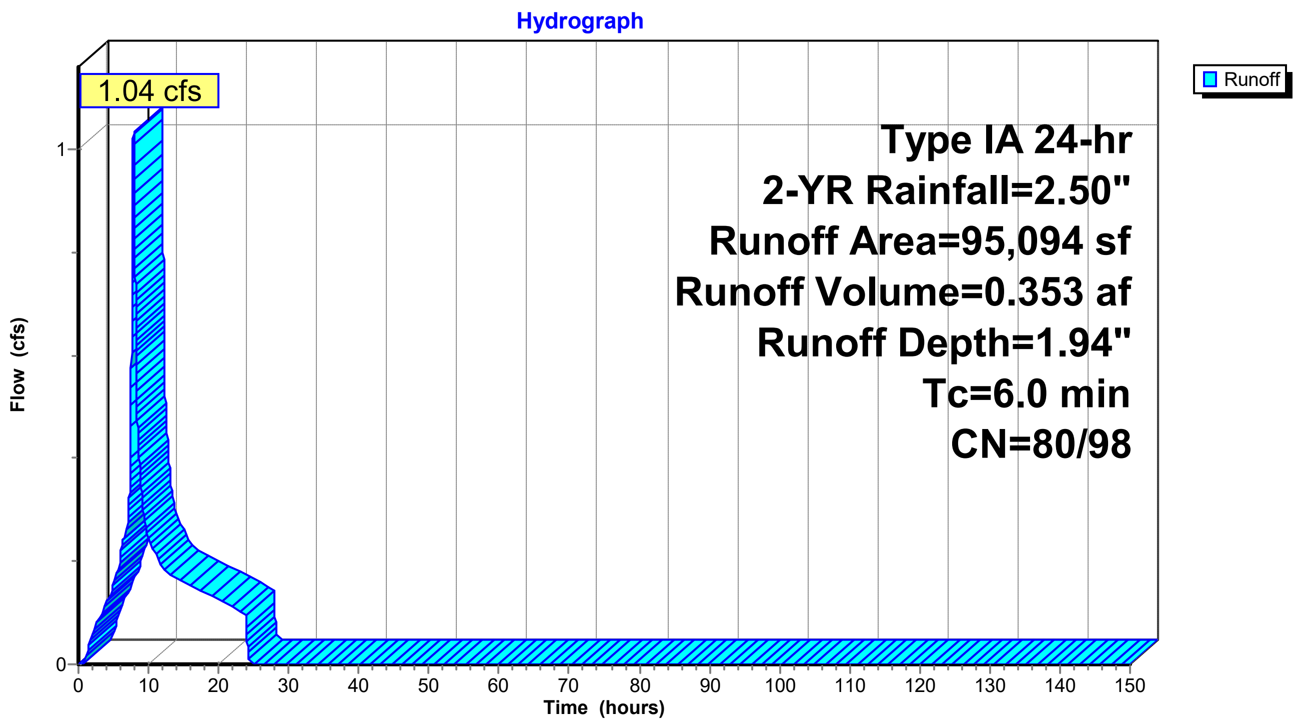
Runoff = 1.04 cfs @ 7.91 hrs, Volume= 0.353 af, Depth= 1.94"
Routed to Pond DP : R-tank - Basin D

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	72,428	98	
*	22,666	80	
	95,094	94	Weighted Average
	22,666	80	23.84% Pervious Area
	72,428	98	76.16% Impervious Area

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

Subcatchment D: Post-Dev - Basin D



Summary for Subcatchment E: Post-Dev - Basin E

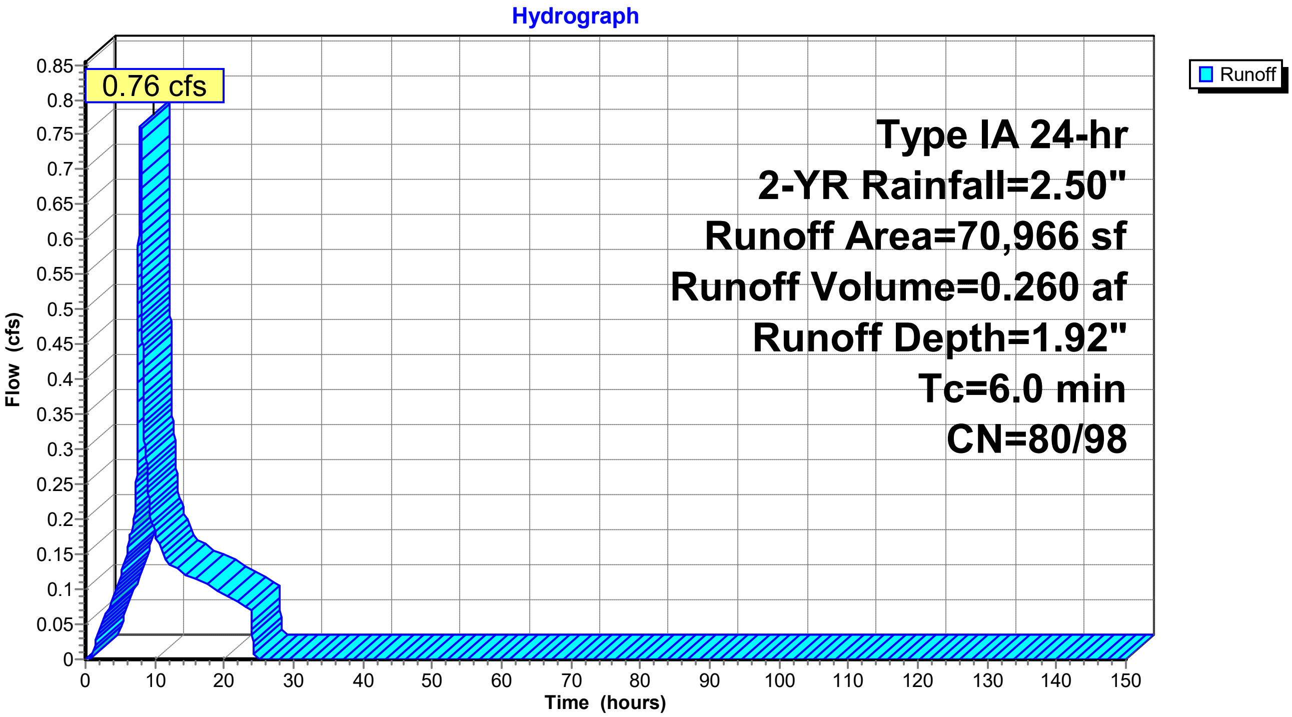
Runoff = 0.76 cfs @ 7.92 hrs, Volume= 0.260 af, Depth= 1.92"
Routed to Pond EP : R-tank - Basin E

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	52,854	98	
*	18,112	80	
	70,966	93	Weighted Average
	18,112	80	25.52% Pervious Area
	52,854	98	74.48% Impervious Area

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

Subcatchment E: Post-Dev - Basin E



Summary for Subcatchment EX: Pre-Dev

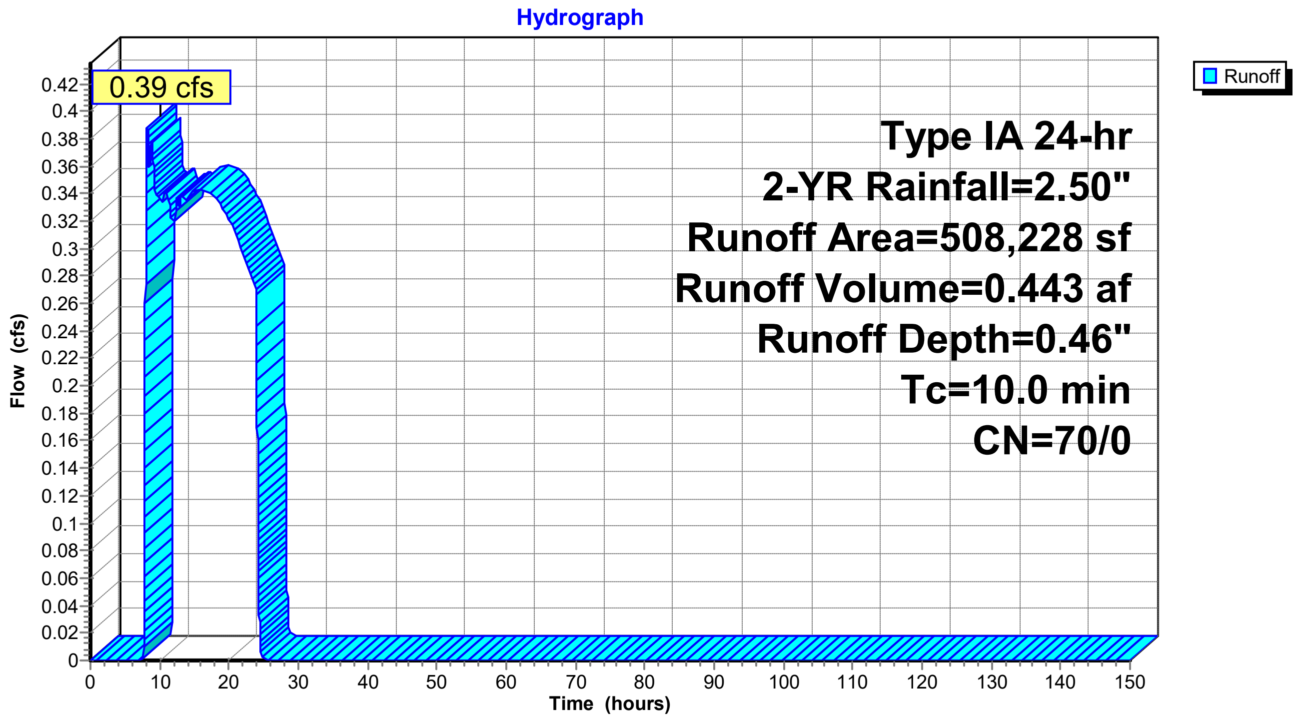
Runoff = 0.39 cfs @ 8.21 hrs, Volume= 0.443 af, Depth= 0.46"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	508,228	70	
	508,228	70	100.00% Pervious Area

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

Subcatchment EX: Pre-Dev



Summary for Subcatchment F: Post-Dev - Basin F

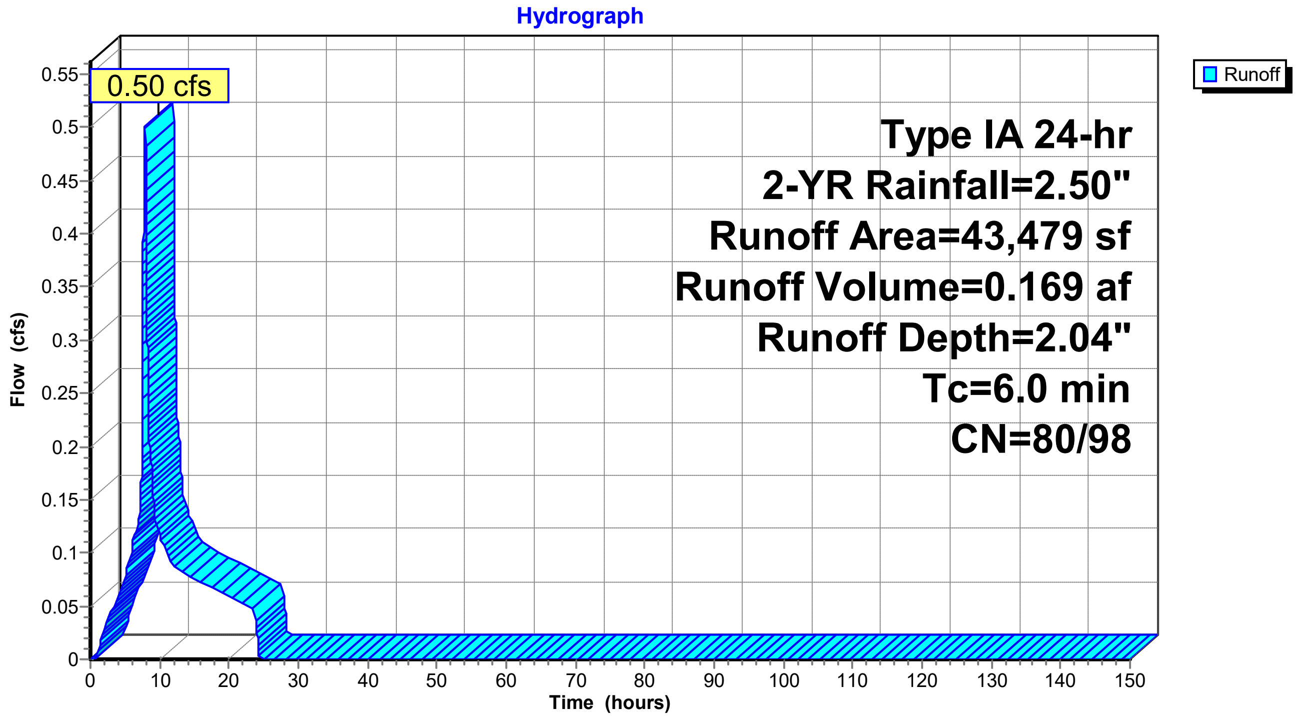
Runoff = 0.50 cfs @ 7.91 hrs, Volume= 0.169 af, Depth= 2.04"
Routed to Pond FP : R-tank - Basin F

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	36,082	98	
*	7,397	80	
	43,479	95	Weighted Average
	7,397	80	17.01% Pervious Area
	36,082	98	82.99% Impervious Area

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

Subcatchment F: Post-Dev - Basin F



Summary for Subcatchment G: Post-Dev - Basin G

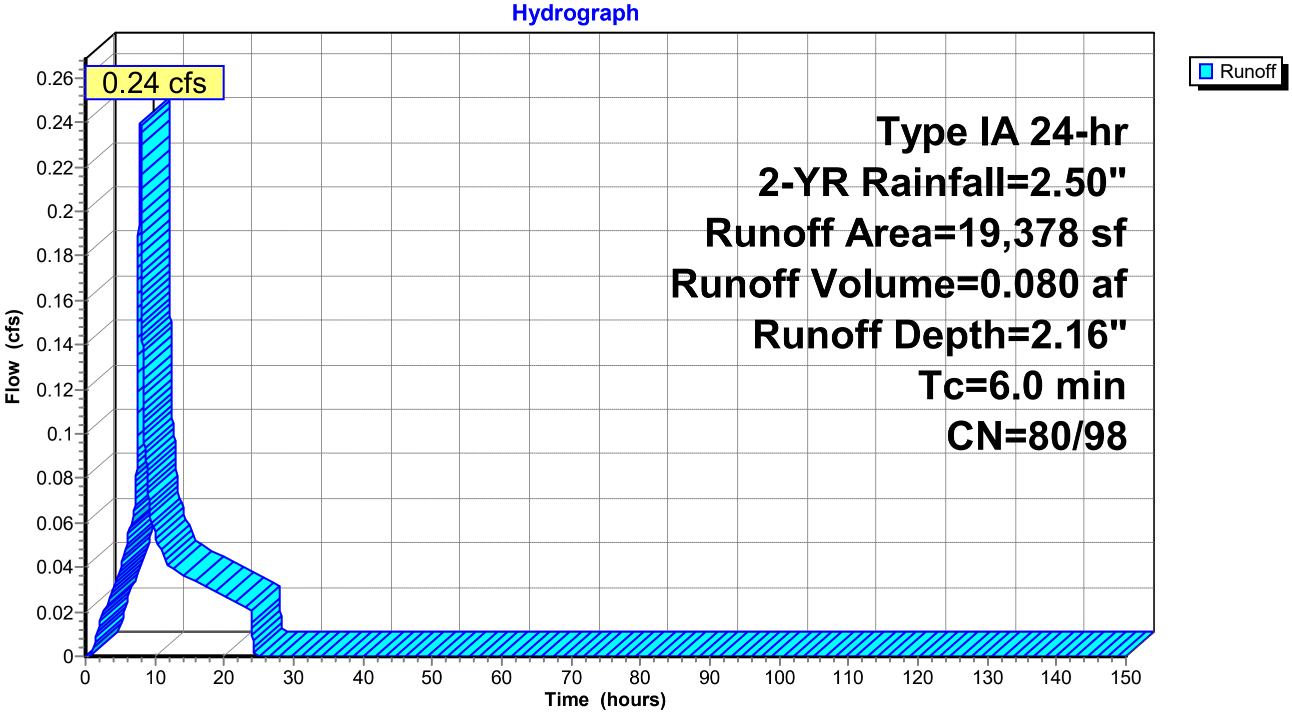
Runoff = 0.24 cfs @ 7.90 hrs, Volume= 0.080 af, Depth= 2.16"
Routed to Pond GP : Planter - Basin G

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	17,831	98	
*	1,547	80	
	19,378	97	Weighted Average
	1,547	80	7.98% Pervious Area
	17,831	98	92.02% Impervious Area

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

Subcatchment G: Post-Dev - Basin G



Summary for Subcatchment H: Post-Dev - Basin H

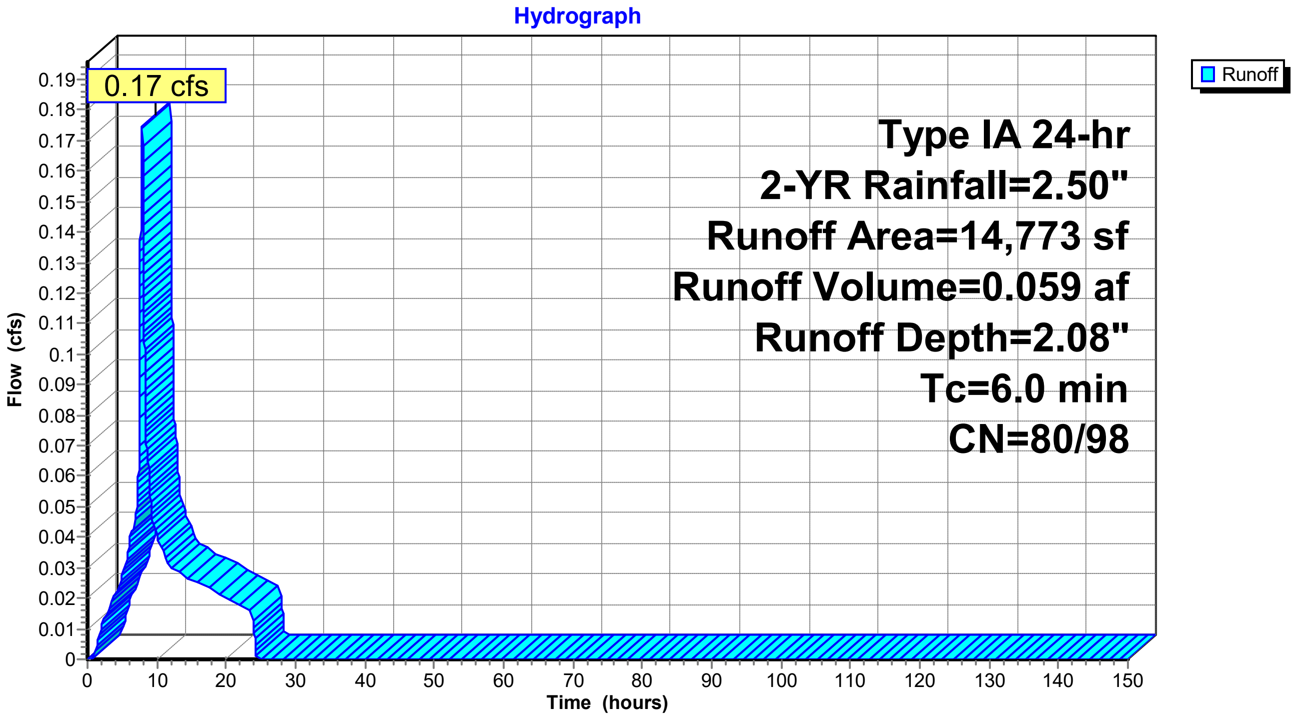
Runoff = 0.17 cfs @ 7.91 hrs, Volume= 0.059 af, Depth= 2.08"
Routed to Pond HP : Planter - Basin H

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	12,740	98	
*	2,033	80	
	14,773	96	Weighted Average
	2,033	80	13.76% Pervious Area
	12,740	98	86.24% Impervious Area

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

Subcatchment H: Post-Dev - Basin H



Summary for Pond AP: R-tank - Basin A

```
Inflow Area =        1.774 ac, 51.80% Impervious,  Inflow Depth =  1.60"   for  2-YR event
Inflow      =       0.67 cfs @    7.94 hrs,  Volume=        0.237 af
Outflow     =       0.06 cfs @   24.02 hrs,  Volume=        0.234 af,  Atten= 90%,  Lag= 964.8 min
Primary     =       0.06 cfs @   24.02 hrs,  Volume=        0.234 af
    Routed to Link PR : Combined - PostDev
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 105.97' @ 24.02 hrs Surf.Area= 0.032 ac Storage= 0.152 af

Plug-Flow detention time= 1,272.7 min calculated for 0.234 af (99% of inflow)
Center-of-Mass det. time= 1,262.6 min (1,983.7 - 721.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.047 af	**13.19'W x 107.22'L x 8.53'H Field A** 0.277 af Overall - 0.159 af Embedded = 0.118 af x 40.0% Voids
#2A	100.00'	0.151 af	**Ferguson R-Tank SD 10** x 308 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 308 Chambers in 7 Rows
		0.198 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.06 cfs @ 24.02 hrs HW=105.97' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.06 cfs of 15.35 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.06 cfs @ 11.72 fps)
  ├─**3=Weir** (Controls 0.00 cfs)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond AP: R-tank - Basin A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

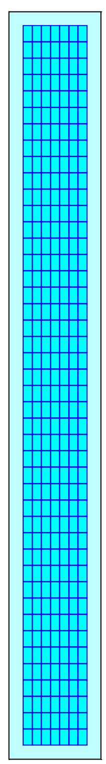
44 Chambers/Row x 2.35' Long = 103.22' Row Length +24.0" End Stone x 2 = 107.22' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

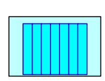
308 Chambers x 21.3 cf = 6,560.7 cf Chamber Storage
308 Chambers x 22.4 cf = 6,906.0 cf Displacement

12,064.4 cf Field - 6,906.0 cf Chambers = 5,158.4 cf Stone x 40.0% Voids = 2,063.4 cf Stone Storage

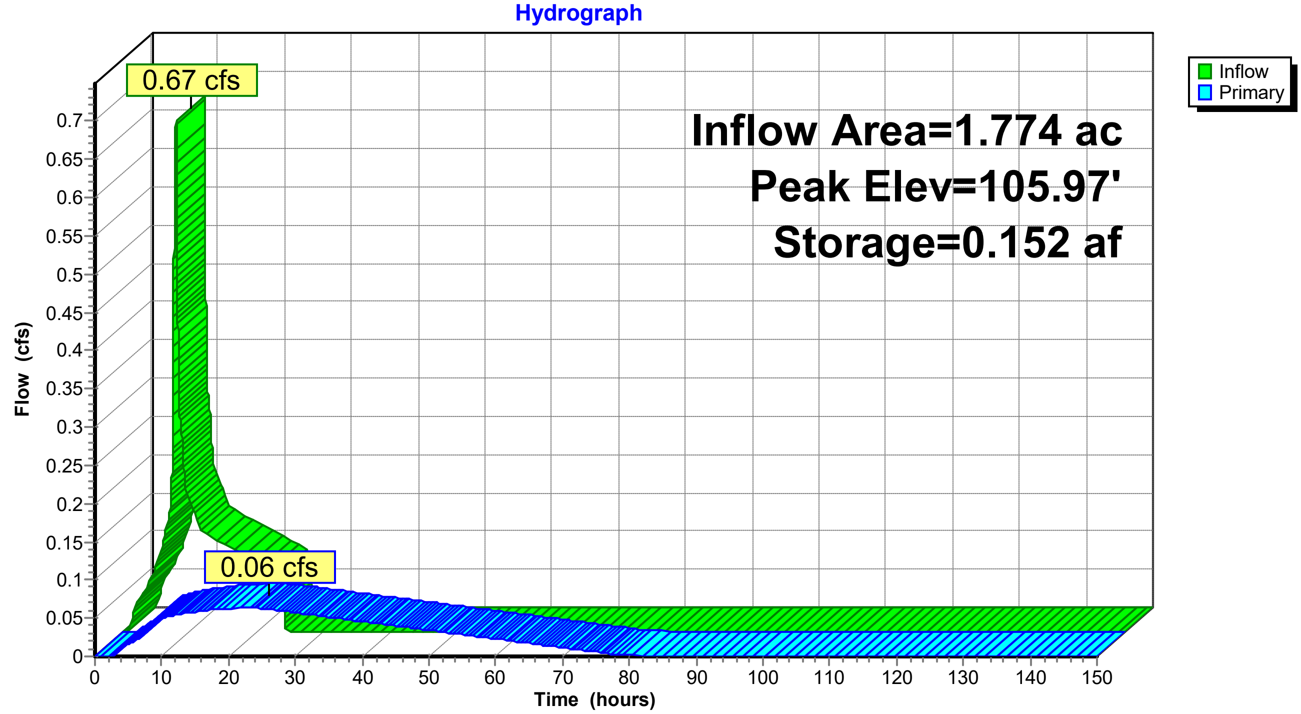
Chamber Storage + Stone Storage = 8,624.1 cf = 0.198 af
Overall Storage Efficiency = 71.5%
Overall System Size = 107.22' x 13.19' x 8.53'

308 Chambers
446.8 cy Field
191.1 cy Stone





Pond AP: R-tank - Basin A



Summary for Pond BP: R-tank - Basin B

Inflow Area = 2.909 ac, 57.33% Impervious, Inflow Depth = 1.68" for 2-YR event
Inflow = 1.16 cfs @ 7.93 hrs, Volume= 0.408 af
Outflow = 0.09 cfs @ 24.03 hrs, Volume= 0.401 af, Atten= 92%, Lag= 966.1 min
Primary = 0.09 cfs @ 24.03 hrs, Volume= 0.401 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 105.95' @ 24.03 hrs Surf.Area= 0.061 ac Storage= 0.287 af

Plug-Flow detention time= 1,634.4 min calculated for 0.401 af (98% of inflow)
Center-of-Mass det. time= 1,623.0 min (2,336.8 - 713.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.087 af	**13.19'W x 201.05'L x 8.53'H Field A** 0.519 af Overall - 0.303 af Embedded = 0.217 af x 40.0% Voids
#2A	100.00'	0.288 af	**Ferguson R-Tank SD 10** x 588 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 588 Chambers in 7 Rows
		0.374 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.2" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.09 cfs @ 24.03 hrs HW=105.95' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.09 cfs of 15.32 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.09 cfs @ 11.69 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond BP: R-tank - Basin B - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

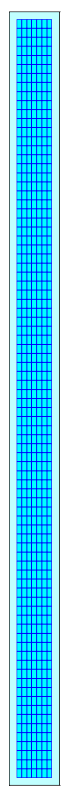
84 Chambers/Row x 2.35' Long = 197.05' Row Length +24.0" End Stone x 2 = 201.05' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

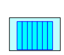
588 Chambers x 21.3 cf = 12,524.9 cf Chamber Storage
588 Chambers x 22.4 cf = 13,184.1 cf Displacement

22,622.9 cf Field - 13,184.1 cf Chambers = 9,438.8 cf Stone x 40.0% Voids = 3,775.5 cf Stone Storage

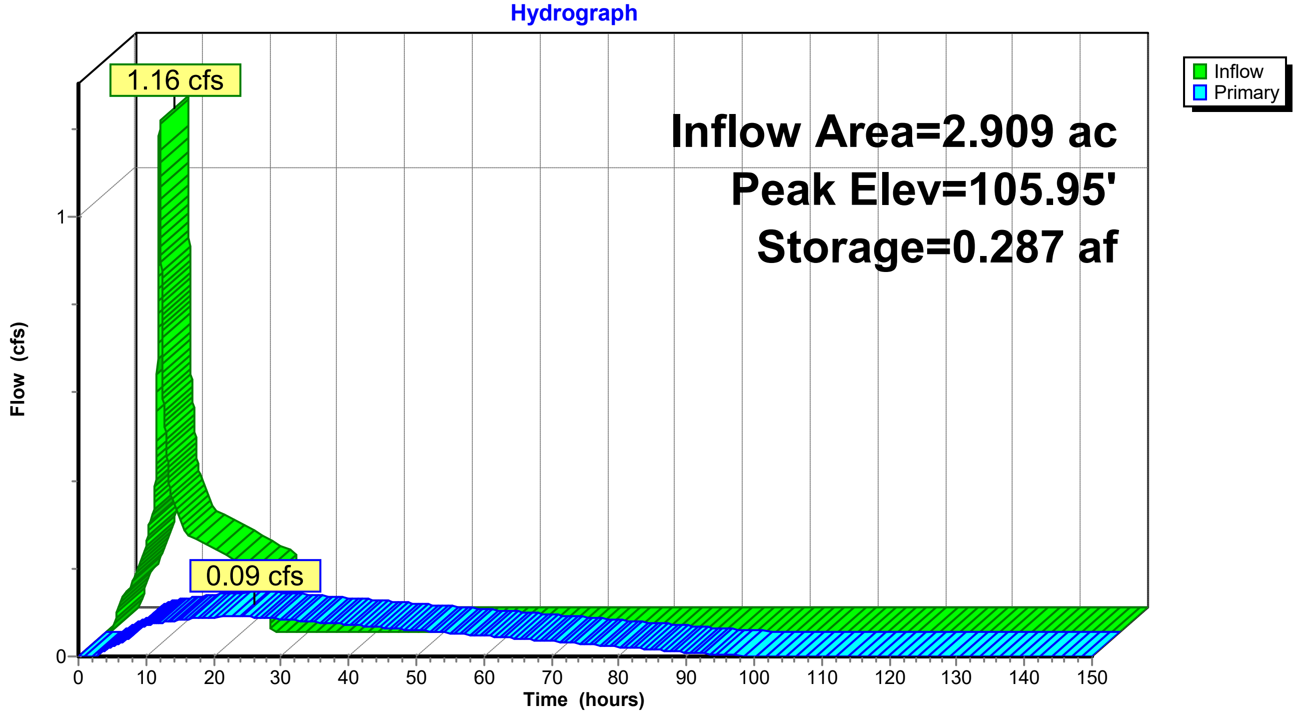
Chamber Storage + Stone Storage = 16,300.4 cf = 0.374 af
Overall Storage Efficiency = 72.1%
Overall System Size = 201.05' x 13.19' x 8.53'

588 Chambers
837.9 cy Field
349.6 cy Stone





Pond BP: R-tank - Basin B



Summary for Pond CP: R-tank - Basin C

Inflow Area = 1.282 ac, 80.45% Impervious, Inflow Depth = 2.00" for 2-YR event
Inflow = 0.63 cfs @ 7.91 hrs, Volume= 0.214 af
Outflow = 0.04 cfs @ 24.04 hrs, Volume= 0.210 af, Atten= 94%, Lag= 967.7 min
Primary = 0.04 cfs @ 24.04 hrs, Volume= 0.210 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 105.97' @ 24.04 hrs Surf.Area= 0.034 ac Storage= 0.159 af

Plug-Flow detention time= 2,001.5 min calculated for 0.210 af (98% of inflow)
Center-of-Mass det. time= 1,989.4 min (2,678.5 - 689.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.049 af	**13.19'W x 111.91'L x 8.53'H Field A** 0.289 af Overall - 0.166 af Embedded = 0.123 af x 40.0% Voids
#2A	100.00'	0.157 af	**Ferguson R-Tank SD 10** x 322 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 322 Chambers in 7 Rows
		0.207 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.8" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.04 cfs @ 24.04 hrs HW=105.97' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.04 cfs of 15.35 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.04 cfs @ 11.73 fps)
  ├─**3=Weir** (Controls 0.00 cfs)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond CP: R-tank - Basin C - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

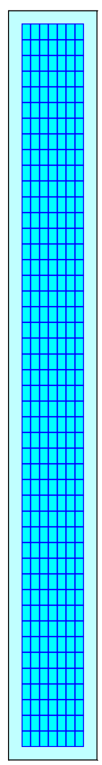
46 Chambers/Row x 2.35' Long = 107.91' Row Length +24.0" End Stone x 2 = 111.91' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

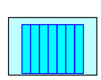
322 Chambers x 21.3 cf = 6,858.9 cf Chamber Storage
322 Chambers x 22.4 cf = 7,219.9 cf Displacement

12,592.3 cf Field - 7,219.9 cf Chambers = 5,372.5 cf Stone x 40.0% Voids = 2,149.0 cf Stone Storage

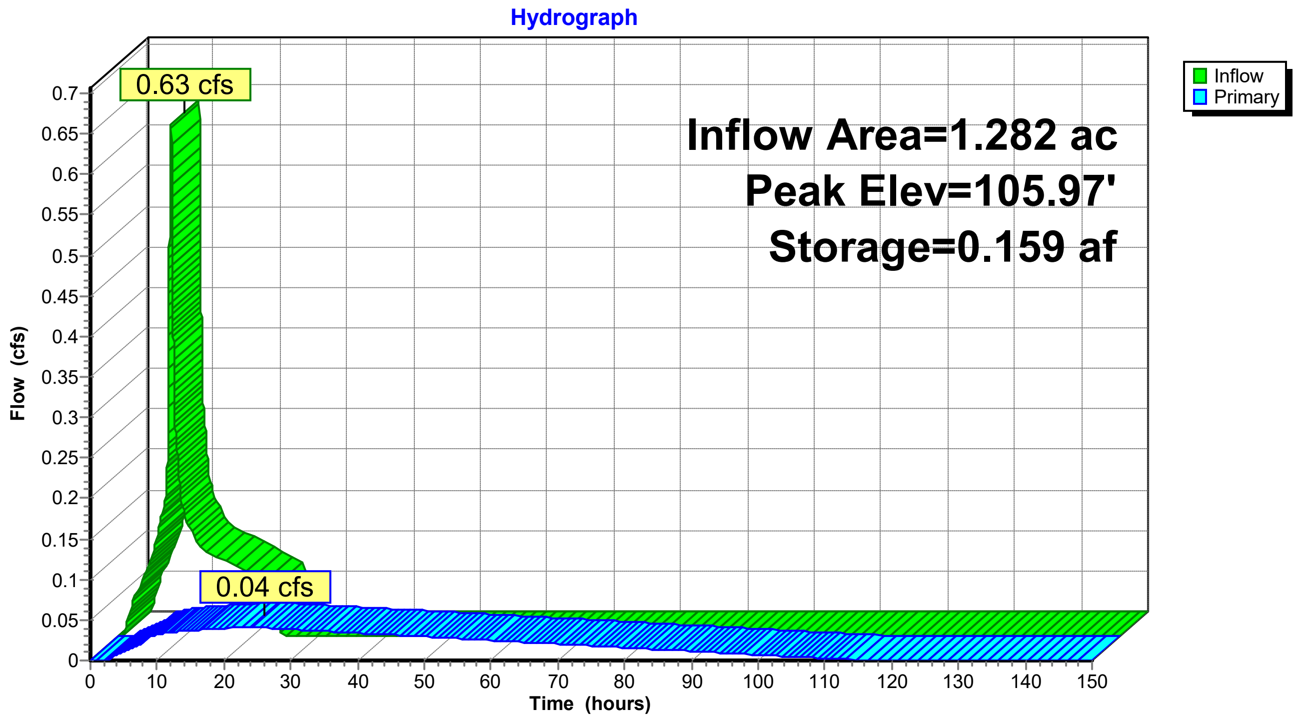
Chamber Storage + Stone Storage = 9,007.9 cf = 0.207 af
Overall Storage Efficiency = 71.5%
Overall System Size = 111.91' x 13.19' x 8.53'

322 Chambers
466.4 cy Field
199.0 cy Stone





Pond CP: R-tank - Basin C



Summary for Pond DP: R-tank - Basin D

```
Inflow Area =        2.183 ac, 76.16% Impervious, Inflow Depth =  1.94"   for 2-YR event
Inflow      =        1.04 cfs @   7.91 hrs, Volume=         0.353 af
Outflow     =        0.06 cfs @  24.05 hrs, Volume=         0.347 af, Atten= 94%, Lag= 967.9 min
Primary     =        0.06 cfs @  24.05 hrs, Volume=         0.347 af
   Routed to Link PR : Combined - PostDev
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 105.92' @ 24.05 hrs Surf.Area= 0.057 ac Storage= 0.269 af

Plug-Flow detention time= 2,162.5 min calculated for 0.347 af (98% of inflow)
Center-of-Mass det. time= 2,149.4 min (2,842.4 - 693.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.082 af	**13.19'W x 189.32'L x 8.53'H Field A** 0.489 af Overall - 0.285 af Embedded = 0.204 af x 40.0% Voids
#2A	100.00'	0.270 af	**Ferguson R-Tank SD 10** x 553 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 553 Chambers in 7 Rows
		0.352 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.06 cfs @ 24.05 hrs HW=105.92' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.06 cfs of 15.28 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.06 cfs @ 11.68 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond DP: R-tank - Basin D - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

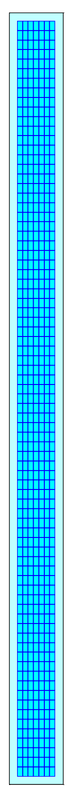
79 Chambers/Row x 2.35' Long = 185.32' Row Length +24.0" End Stone x 2 = 189.32' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

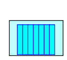
553 Chambers x 21.3 cf = 11,779.4 cf Chamber Storage
553 Chambers x 22.4 cf = 12,399.4 cf Displacement

21,303.1 cf Field - 12,399.4 cf Chambers = 8,903.7 cf Stone x 40.0% Voids = 3,561.5 cf Stone Storage

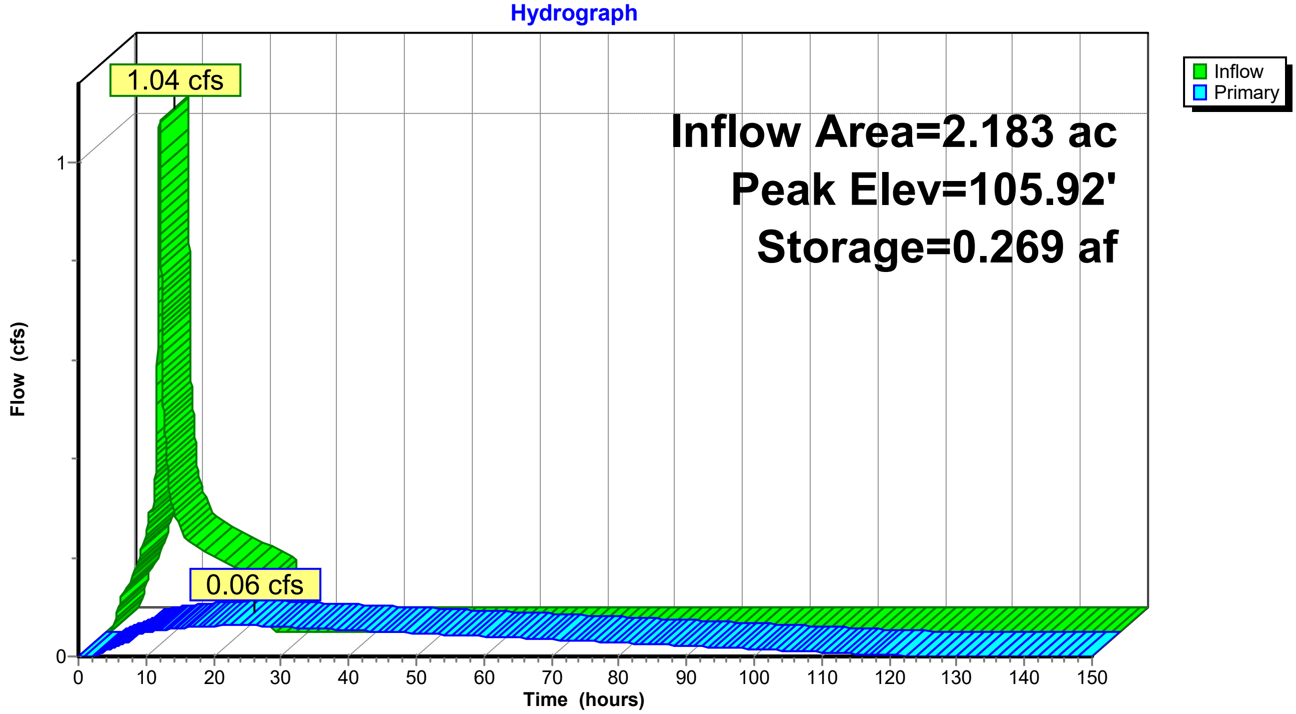
Chamber Storage + Stone Storage = 15,340.9 cf = 0.352 af
Overall Storage Efficiency = 72.0%
Overall System Size = 189.32' x 13.19' x 8.53'

553 Chambers
789.0 cy Field
329.8 cy Stone





Pond DP: R-tank - Basin D



Summary for Pond EP: R-tank - Basin E

Inflow Area = 1.629 ac, 74.48% Impervious, Inflow Depth = 1.92" for 2-YR event
Inflow = 0.76 cfs @ 7.92 hrs, Volume= 0.260 af
Outflow = 0.07 cfs @ 24.01 hrs, Volume= 0.208 af, Atten= 91%, Lag= 965.4 min
Primary = 0.07 cfs @ 24.01 hrs, Volume= 0.208 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.01' @ 24.01 hrs Surf.Area= 0.048 ac Storage= 0.228 af

Plug-Flow detention time= 3,600.3 min calculated for 0.208 af (80% of inflow)
Center-of-Mass det. time= 3,467.8 min (4,162.5 - 694.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.069 af	**13.19'W x 158.82'L x 8.53'H Field A** 0.410 af Overall - 0.238 af Embedded = 0.172 af x 40.0% Voids
#2A	100.00'	0.226 af	**Ferguson R-Tank SD 10** x 462 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 462 Chambers in 7 Rows
		0.295 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.6" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.07 cfs @ 24.01 hrs HW=106.01' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.07 cfs of 15.40 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.02 cfs @ 11.78 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.05 cfs @ 0.63 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond EP: R-tank - Basin E - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

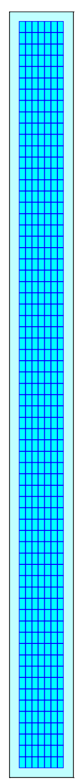
66 Chambers/Row x 2.35' Long = 154.82' Row Length +24.0" End Stone x 2 = 158.82' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

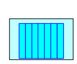
462 Chambers x 21.3 cf = 9,841.0 cf Chamber Storage
462 Chambers x 22.4 cf = 10,359.0 cf Displacement

17,871.6 cf Field - 10,359.0 cf Chambers = 7,512.6 cf Stone x 40.0% Voids = 3,005.0 cf Stone Storage

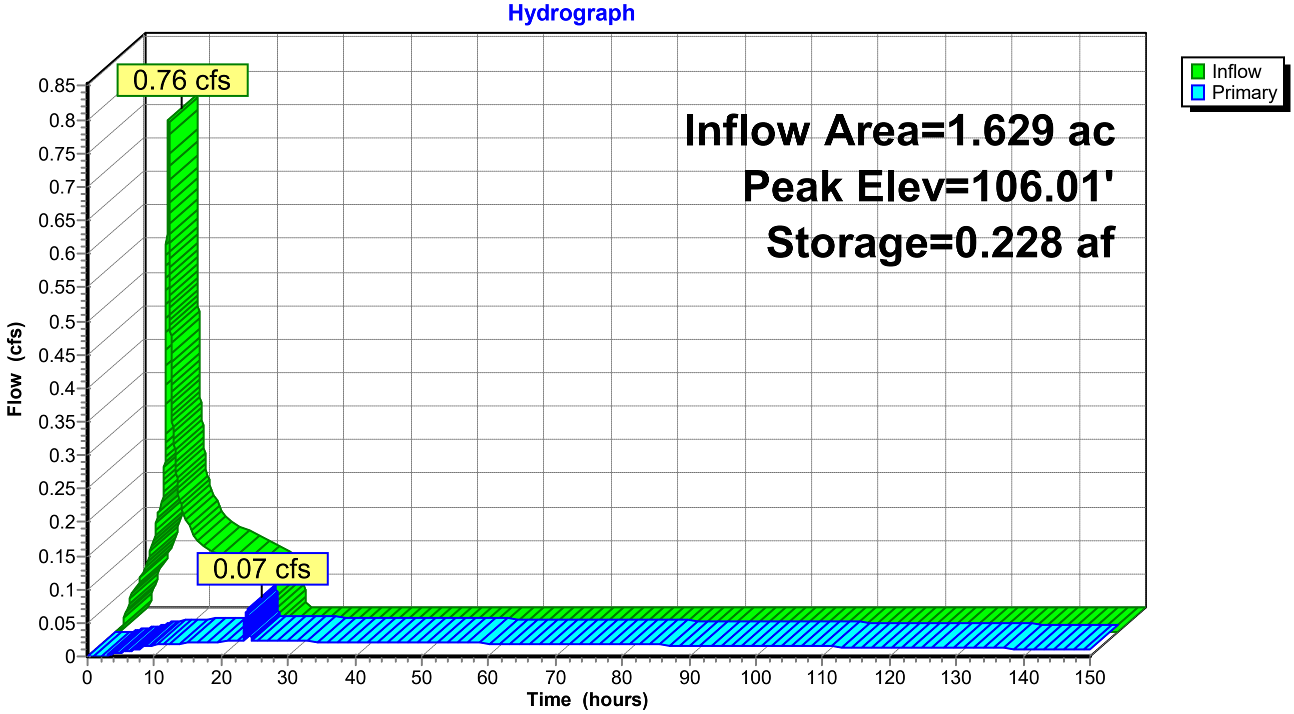
Chamber Storage + Stone Storage = 12,846.1 cf = 0.295 af
Overall Storage Efficiency = 71.9%
Overall System Size = 158.82' x 13.19' x 8.53'

462 Chambers
661.9 cy Field
278.2 cy Stone





Pond EP: R-tank - Basin E



Summary for Pond FP: R-tank - Basin F

Inflow Area = 0.998 ac, 82.99% Impervious, Inflow Depth = 2.04" for 2-YR event
Inflow = 0.50 cfs @ 7.91 hrs, Volume= 0.169 af
Outflow = 0.03 cfs @ 24.04 hrs, Volume= 0.166 af, Atten= 94%, Lag= 968.0 min
Primary = 0.03 cfs @ 24.04 hrs, Volume= 0.166 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 105.79' @ 24.04 hrs Surf.Area= 0.028 ac Storage= 0.128 af

Plug-Flow detention time= 2,125.7 min calculated for 0.166 af (98% of inflow)
Center-of-Mass det. time= 2,112.9 min (2,799.8 - 686.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.041 af	**13.19'W x 93.14'L x 8.53'H Field A** 0.241 af Overall - 0.137 af Embedded = 0.104 af x 40.0% Voids
#2A	100.00'	0.130 af	**Ferguson R-Tank SD 10** x 266 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 266 Chambers in 7 Rows
		0.172 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.7" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.03 cfs @ 24.04 hrs HW=105.79' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.03 cfs of 15.09 cfs potential flow)
├─**2=Primary Orifice** (Orifice Controls 0.03 cfs @ 11.56 fps)
├─**3=Weir** (Controls 0.00 cfs)
└─**4=Overflow Riser** (Controls 0.00 cfs)

Pond FP: R-tank - Basin F - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

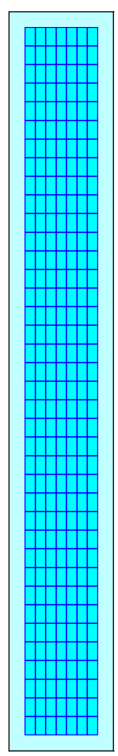
38 Chambers/Row x 2.35' Long = 89.14' Row Length +24.0" End Stone x 2 = 93.14' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

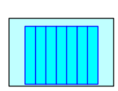
266 Chambers x 21.3 cf = 5,666.0 cf Chamber Storage
266 Chambers x 22.4 cf = 5,964.2 cf Displacement

10,480.7 cf Field - 5,964.2 cf Chambers = 4,516.4 cf Stone x 40.0% Voids = 1,806.6 cf Stone Storage

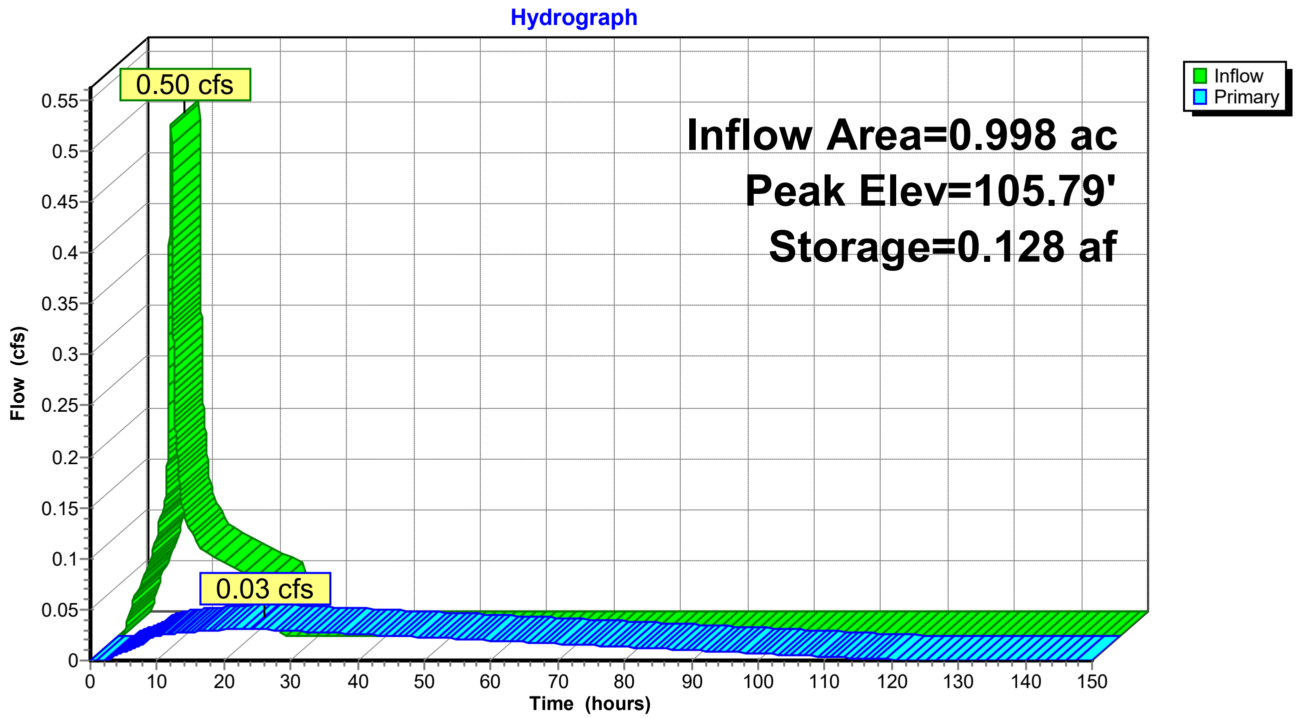
Chamber Storage + Stone Storage = 7,472.6 cf = 0.172 af
Overall Storage Efficiency = 71.3%
Overall System Size = 93.14' x 13.19' x 8.53'

266 Chambers
388.2 cy Field
167.3 cy Stone





Pond FP: R-tank - Basin F



Summary for Pond GP: Planter - Basin G

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 0.445 ac, 92.02% Impervious, Inflow Depth = 2.16" for 2-YR event
Inflow = 0.24 cfs @ 7.90 hrs, Volume= 0.080 af
Outflow = 0.01 cfs @ 24.05 hrs, Volume= 0.078 af, Atten= 95%, Lag= 969.1 min
Primary = 0.01 cfs @ 24.05 hrs, Volume= 0.078 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.84' @ 24.05 hrs Surf.Area= 2,320 sf Storage= 2,834 cf

Plug-Flow detention time= 2,926.7 min calculated for 0.078 af (98% of inflow)
Center-of-Mass det. time= 2,911.3 min (3,590.8 - 679.5)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	2,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,856 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,640 cf Overall x 40.0% Voids
		4,176 cf	Total Available Storage

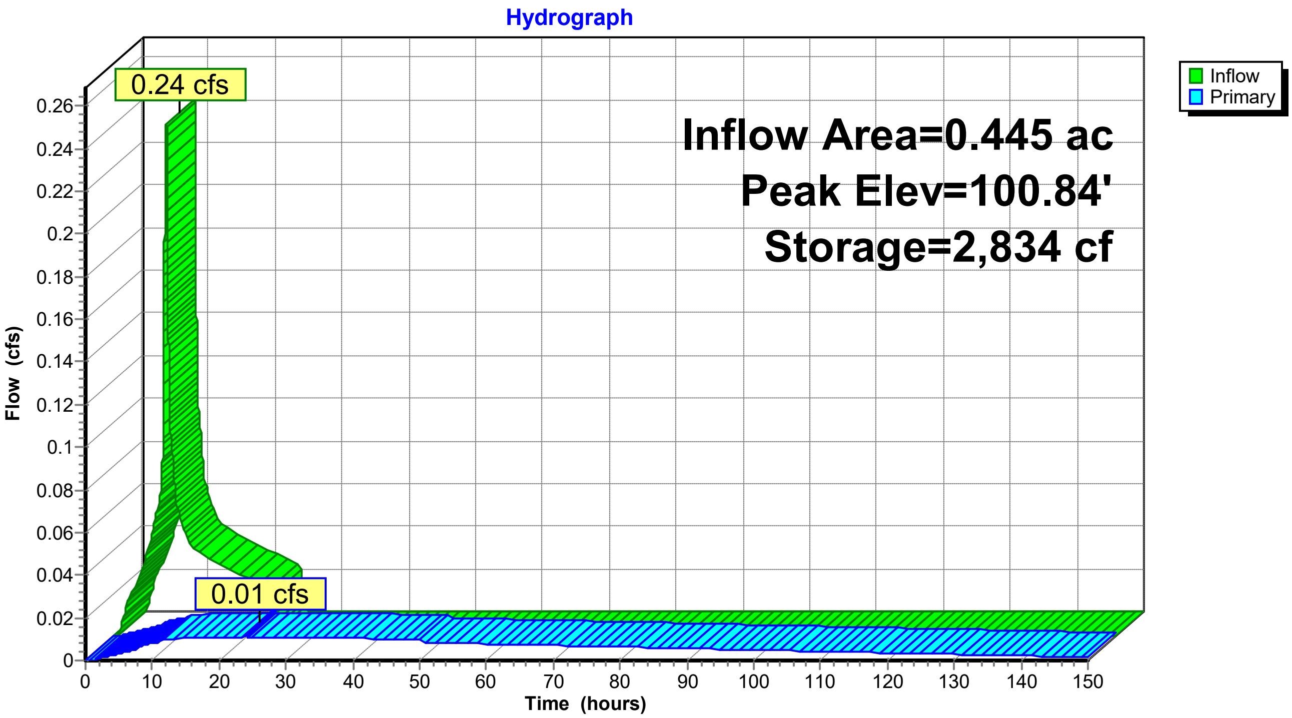
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	1,160	0	0
102.00	1,160	2,320	2,320

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	1,160	0	0
98.25	1,160	4,640	4,640

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.84'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.01 cfs @ 24.05 hrs HW=100.84' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.01 cfs of 16.24 cfs potential flow)
  ├**3=Orifice A** (Orifice Controls 0.01 cfs @ 12.35 fps)
  │ ├**2=Beehive OF** (Controls 0.00 cfs)
  │ └**4=Underdrain** (Passes 0.01 cfs of 2.38 cfs potential flow)
  └**5=Orifice B** (Weir Controls 0.00 cfs @ 0.18 fps)

Pond GP: Planter - Basin G



Summary for Pond HP: Planter - Basin H

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 0.339 ac, 86.24% Impervious, Inflow Depth = 2.08" for 2-YR event
Inflow = 0.17 cfs @ 7.91 hrs, Volume= 0.059 af
Outflow = 0.01 cfs @ 24.04 hrs, Volume= 0.059 af, Atten= 94%, Lag= 968.0 min
Primary = 0.01 cfs @ 24.04 hrs, Volume= 0.059 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.96' @ 24.04 hrs Surf.Area= 1,476 sf Storage= 1,889 cf

Plug-Flow detention time= 2,020.3 min calculated for 0.059 af (100% of inflow)
Center-of-Mass det. time= 2,020.1 min (2,704.1 - 684.1)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,476 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,181 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
			2,952 cf Overall x 40.0% Voids
		2,657 cf	Total Available Storage

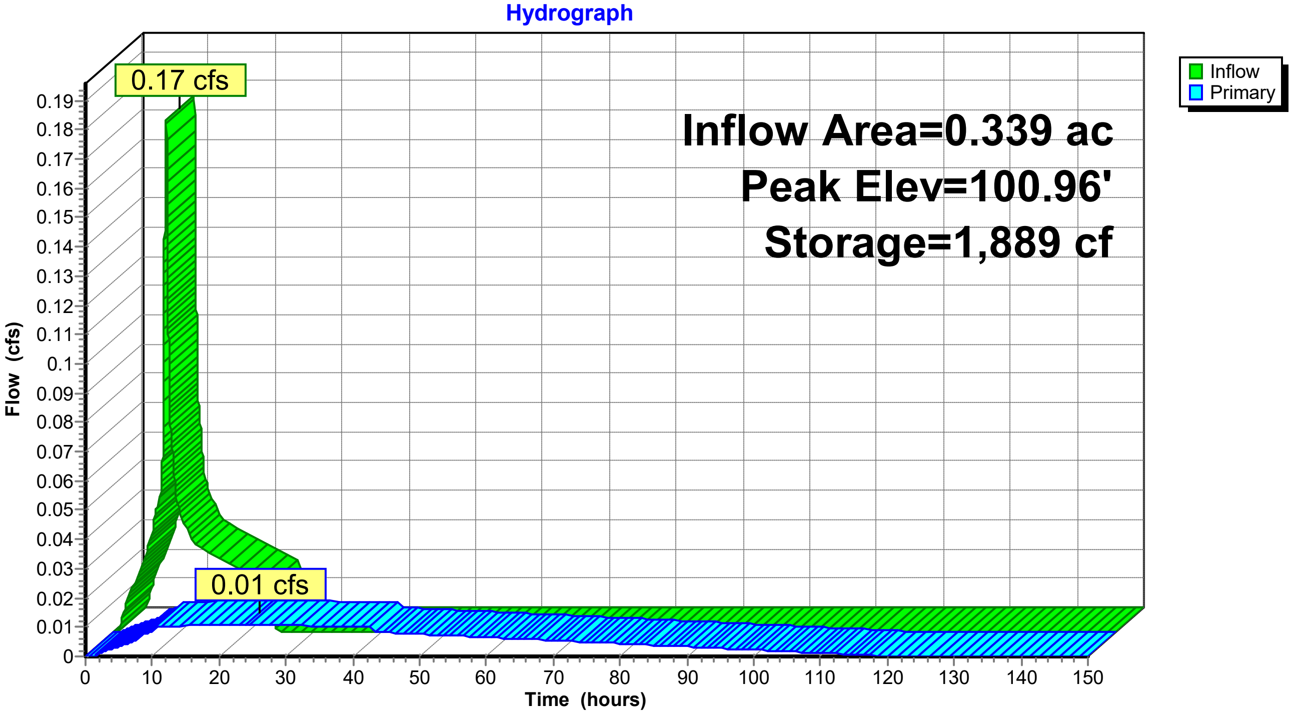
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	738	0	0
102.00	738	1,476	1,476

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	738	0	0
98.25	738	2,952	2,952

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert**
			L= 10.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900
			n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.96'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.01 cfs @ 24.04 hrs HW=100.96' TW=0.00' (Dynamic Tailwater)
1=Culvert (Passes 0.01 cfs of 16.40 cfs potential flow)
3=Orifice A (Orifice Controls 0.01 cfs @ 12.46 fps)
2=Beehive OF (Controls 0.00 cfs)
4=Underdrain (Passes 0.01 cfs of 2.40 cfs potential flow)
5=Orifice B (Controls 0.00 cfs)

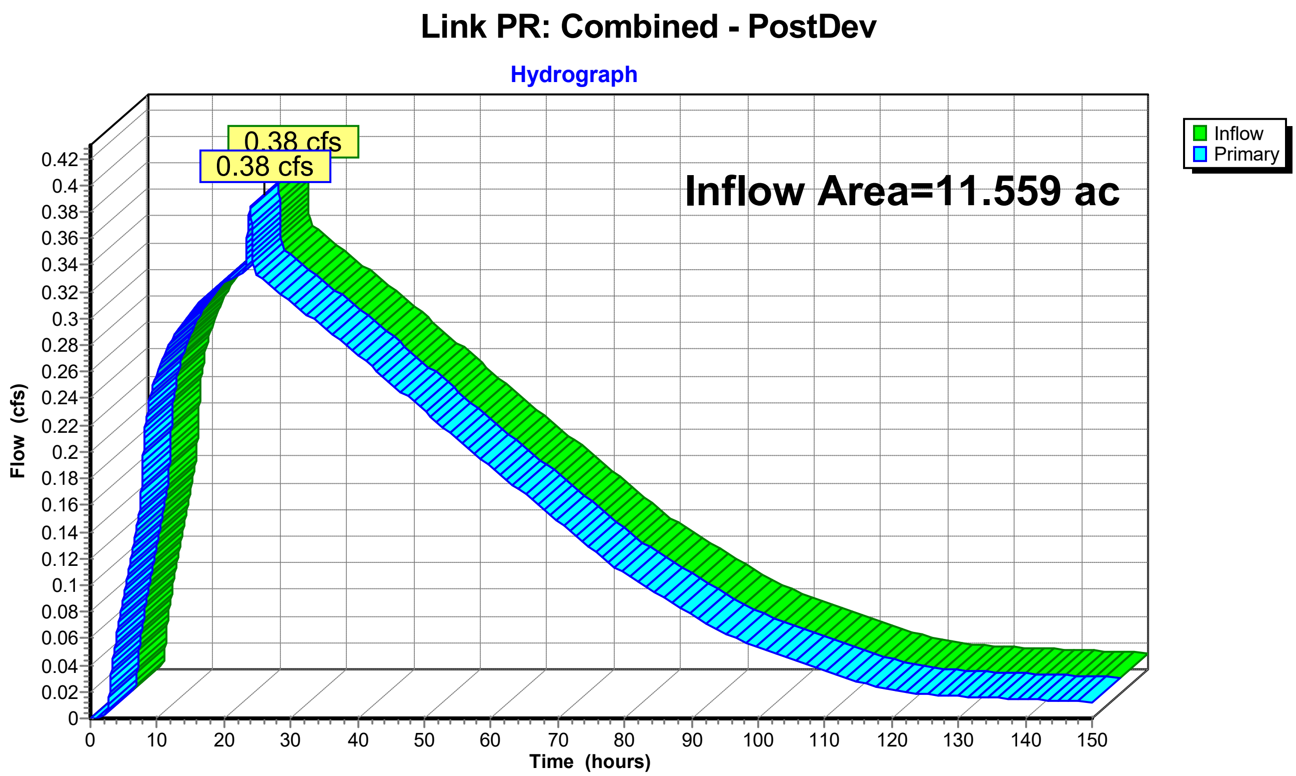
Pond HP: Planter - Basin H



Summary for Link PR: Combined - PostDev

Inflow Area = 11.559 ac, 69.42% Impervious, Inflow Depth > 1.77" for 2-YR event
Inflow = 0.38 cfs @ 24.01 hrs, Volume= 1.704 af
Primary = 0.38 cfs @ 24.01 hrs, Volume= 1.704 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs



Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A: Post-Dev - Basin A Runoff Area=77,258 sf 51.80% Impervious Runoff Depth=2.44"
Tc=6.0 min CN=80/98 Runoff=1.04 cfs 0.360 af

Subcatchment B: Post-Dev - Basin B Runoff Area=126,737 sf 57.33% Impervious Runoff Depth=2.53"
Tc=6.0 min CN=80/98 Runoff=1.77 cfs 0.612 af

Subcatchment C: Post-Dev - Basin C Runoff Area=55,842 sf 80.45% Impervious Runoff Depth=2.90"
Tc=6.0 min CN=80/98 Runoff=0.91 cfs 0.310 af

Subcatchment D: Post-Dev - Basin D Runoff Area=95,094 sf 76.16% Impervious Runoff Depth=2.83"
Tc=6.0 min CN=80/98 Runoff=1.51 cfs 0.515 af

Subcatchment E: Post-Dev - Basin E Runoff Area=70,966 sf 74.48% Impervious Runoff Depth=2.80"
Tc=6.0 min CN=80/98 Runoff=1.12 cfs 0.381 af

Subcatchment EX: Pre-Dev Runoff Area=508,228 sf 0.00% Impervious Runoff Depth=0.98"
Tc=10.0 min CN=70/0 Runoff=1.74 cfs 0.950 af

Subcatchment F: Post-Dev - Basin F Runoff Area=43,479 sf 82.99% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=80/98 Runoff=0.72 cfs 0.245 af

Subcatchment G: Post-Dev - Basin G Runoff Area=19,378 sf 92.02% Impervious Runoff Depth=3.09"
Tc=6.0 min CN=80/98 Runoff=0.34 cfs 0.114 af

Subcatchment H: Post-Dev - Basin H Runoff Area=14,773 sf 86.24% Impervious Runoff Depth=2.99"
Tc=6.0 min CN=80/98 Runoff=0.25 cfs 0.085 af

Pond AP: R-tank - Basin A Peak Elev=106.08' Storage=0.155 af Inflow=1.04 cfs 0.360 af
Outflow=0.24 cfs 0.357 af

Pond BP: R-tank - Basin B Peak Elev=106.09' Storage=0.293 af Inflow=1.77 cfs 0.612 af
Outflow=0.36 cfs 0.606 af

Pond CP: R-tank - Basin C Peak Elev=106.06' Storage=0.161 af Inflow=0.91 cfs 0.310 af
Outflow=0.17 cfs 0.306 af

Pond DP: R-tank - Basin D Peak Elev=106.07' Storage=0.275 af Inflow=1.51 cfs 0.515 af
Outflow=0.26 cfs 0.509 af

Pond EP: R-tank - Basin E Peak Elev=106.06' Storage=0.230 af Inflow=1.12 cfs 0.381 af
Outflow=0.19 cfs 0.328 af

Pond FP: R-tank - Basin F Peak Elev=106.04' Storage=0.133 af Inflow=0.72 cfs 0.245 af
Outflow=0.12 cfs 0.242 af

Pond GP: Planter - Basin G Peak Elev=100.87' Storage=2,862 cf Inflow=0.34 cfs 0.114 af
Outflow=0.06 cfs 0.113 af

Pond HP: Planter - Basin H Peak Elev=100.98' Storage=1,907 cf Inflow=0.25 cfs 0.085 af
Outflow=0.05 cfs 0.085 af

Link PR: Combined - PostDev Inflow=1.31 cfs 2.545 af
Primary=1.31 cfs 2.545 af

Total Runoff Area = 23.227 ac Runoff Volume = 3.572 af Average Runoff Depth = 1.85"
65.45% Pervious = 15.202 ac 34.55% Impervious = 8.024 ac

Summary for Subcatchment A: Post-Dev - Basin A

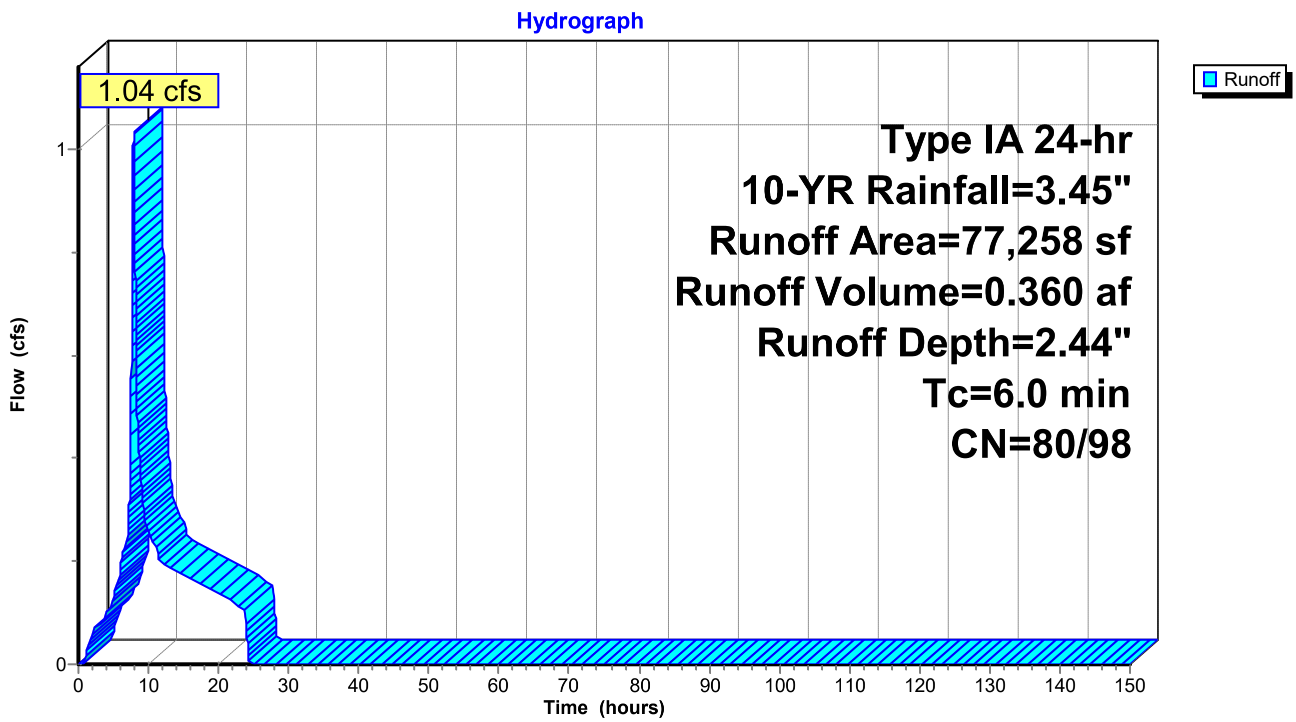
Runoff = 1.04 cfs @ 7.93 hrs, Volume= 0.360 af, Depth= 2.44"
Routed to Pond AP : R-tank - Basin A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	40,023	98	
*	37,235	80	
	77,258	89	Weighted Average
	37,235	80	48.20% Pervious Area
	40,023	98	51.80% Impervious Area

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

Subcatchment A: Post-Dev - Basin A



Summary for Subcatchment B: Post-Dev - Basin B

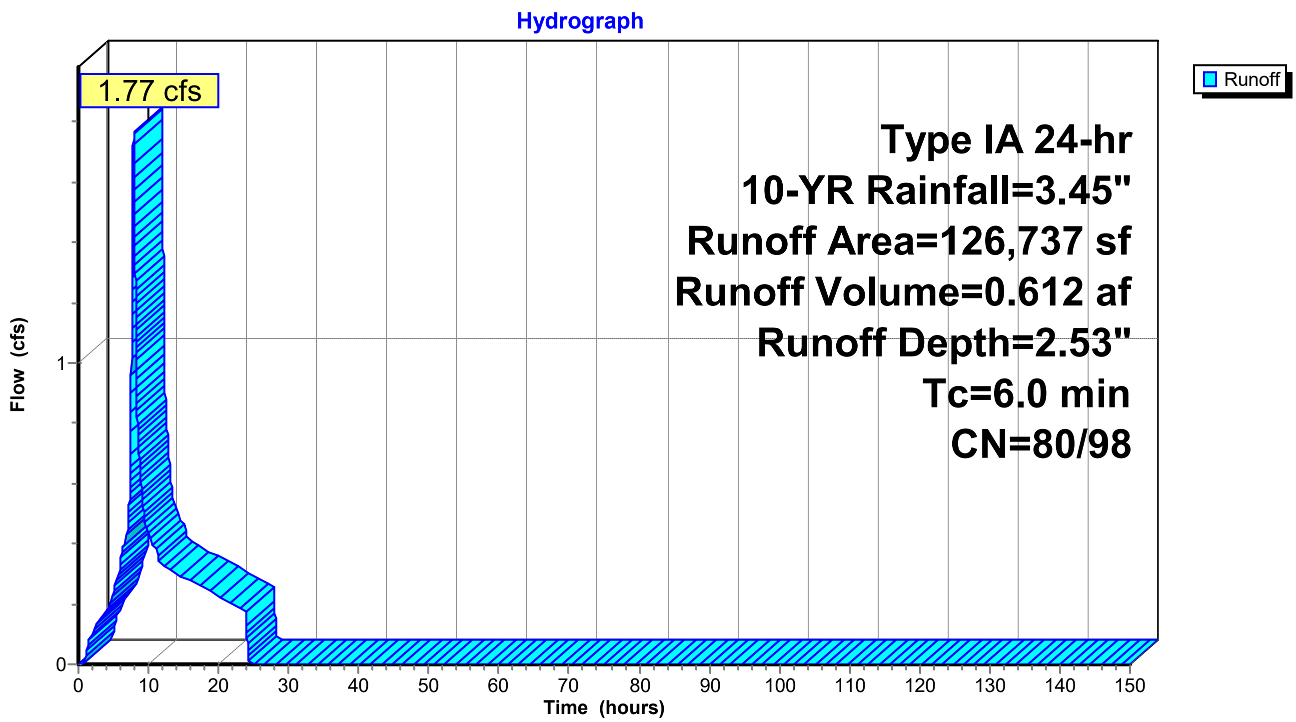
Runoff = 1.77 cfs @ 7.92 hrs, Volume= 0.612 af, Depth= 2.53"
Routed to Pond BP : R-tank - Basin B

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	72,652	98	
*	54,085	80	
	126,737	90	Weighted Average
	54,085	80	42.67% Pervious Area
	72,652	98	57.33% Impervious Area

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

Subcatchment B: Post-Dev - Basin B



Summary for Subcatchment C: Post-Dev - Basin C

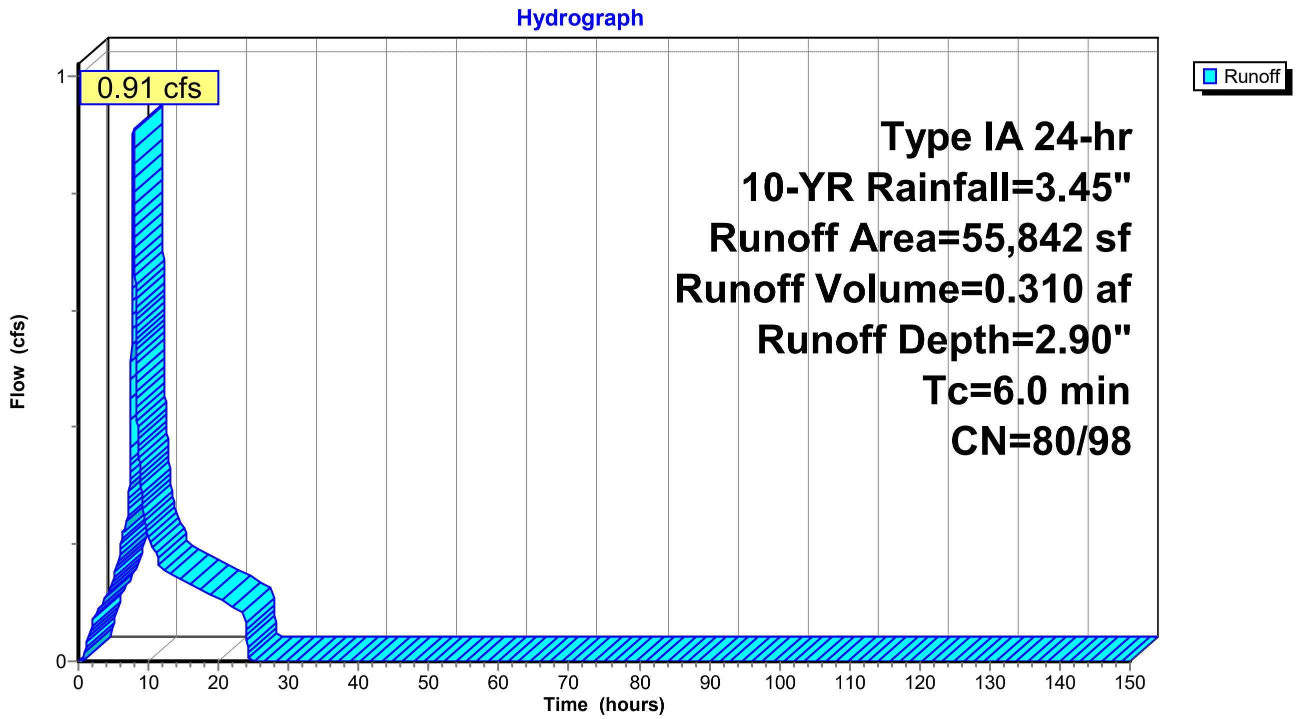
Runoff = 0.91 cfs @ 7.91 hrs, Volume= 0.310 af, Depth= 2.90"
Routed to Pond CP : R-tank - Basin C

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	44,926	98	
*	10,916	80	
	55,842	94	Weighted Average
	10,916	80	19.55% Pervious Area
	44,926	98	80.45% Impervious Area

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

Subcatchment C: Post-Dev - Basin C



Summary for Subcatchment D: Post-Dev - Basin D

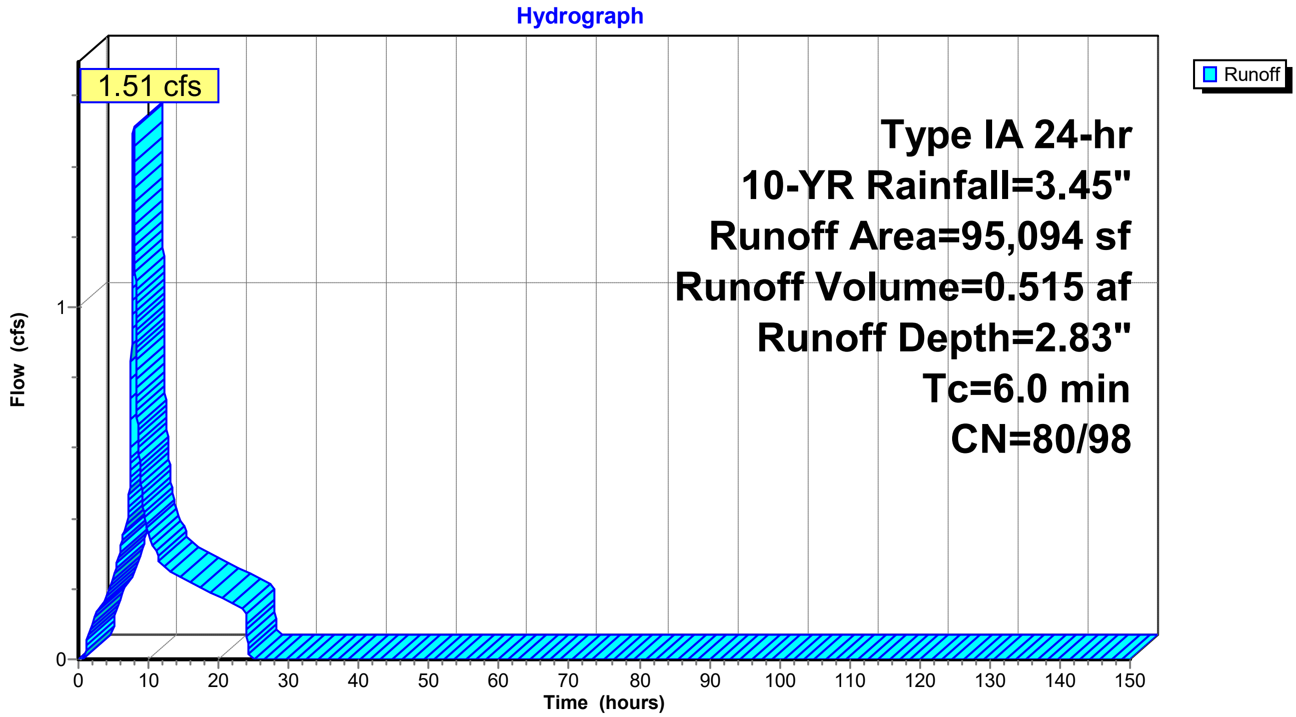
Runoff = 1.51 cfs @ 7.91 hrs, Volume= 0.515 af, Depth= 2.83"
Routed to Pond DP : R-tank - Basin D

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	72,428	98	
*	22,666	80	
	95,094	94	Weighted Average
	22,666	80	23.84% Pervious Area
	72,428	98	76.16% Impervious Area

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

Subcatchment D: Post-Dev - Basin D



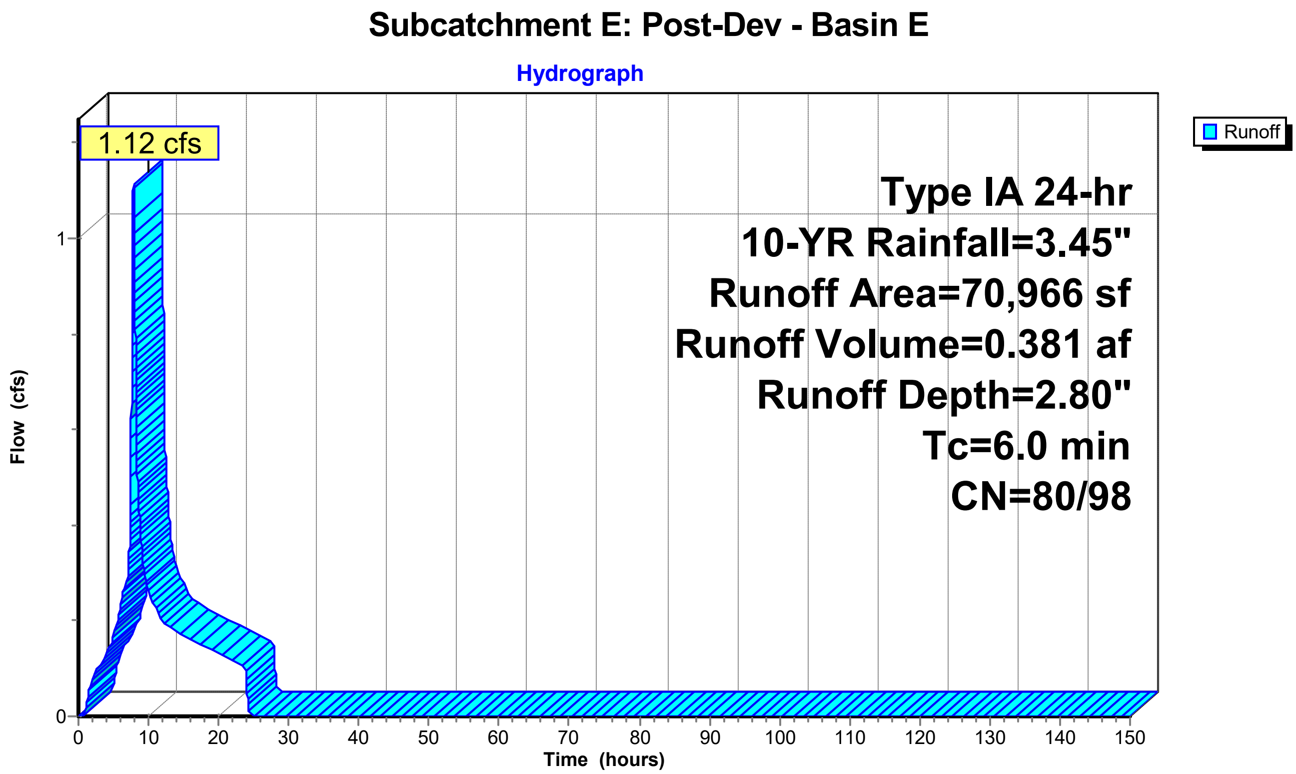
Summary for Subcatchment E: Post-Dev - Basin E

Runoff = 1.12 cfs @ 7.91 hrs, Volume= 0.381 af, Depth= 2.80"
Routed to Pond EP : R-tank - Basin E

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	52,854	98	
*	18,112	80	
	70,966	93	Weighted Average
	18,112	80	25.52% Pervious Area
	52,854	98	74.48% Impervious Area

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



Summary for Subcatchment EX: Pre-Dev

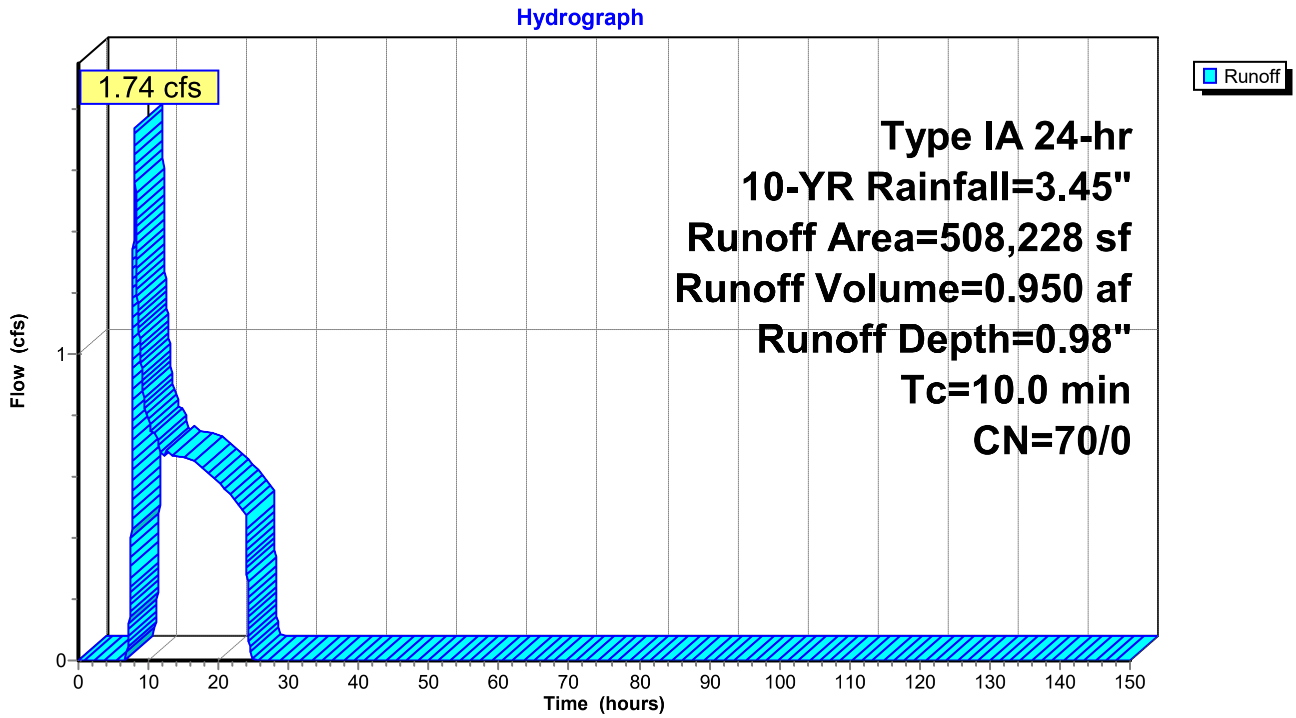
Runoff = 1.74 cfs @ 8.01 hrs, Volume= 0.950 af, Depth= 0.98"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	508,228	70	
	508,228	70	100.00% Pervious Area

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

Subcatchment EX: Pre-Dev



Summary for Subcatchment F: Post-Dev - Basin F

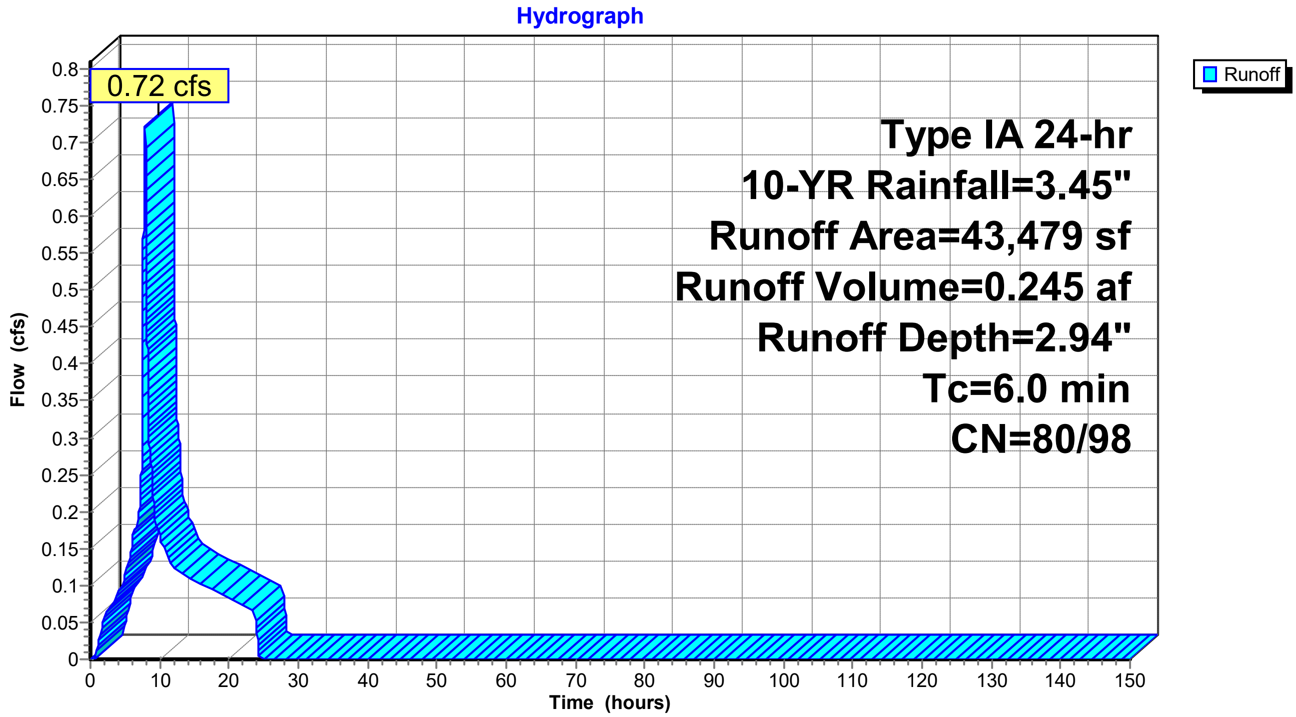
Runoff = 0.72 cfs @ 7.91 hrs, Volume= 0.245 af, Depth= 2.94"
Routed to Pond FP : R-tank - Basin F

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	36,082	98	
*	7,397	80	
	43,479	95	Weighted Average
	7,397	80	17.01% Pervious Area
	36,082	98	82.99% Impervious Area

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

Subcatchment F: Post-Dev - Basin F



Summary for Subcatchment G: Post-Dev - Basin G

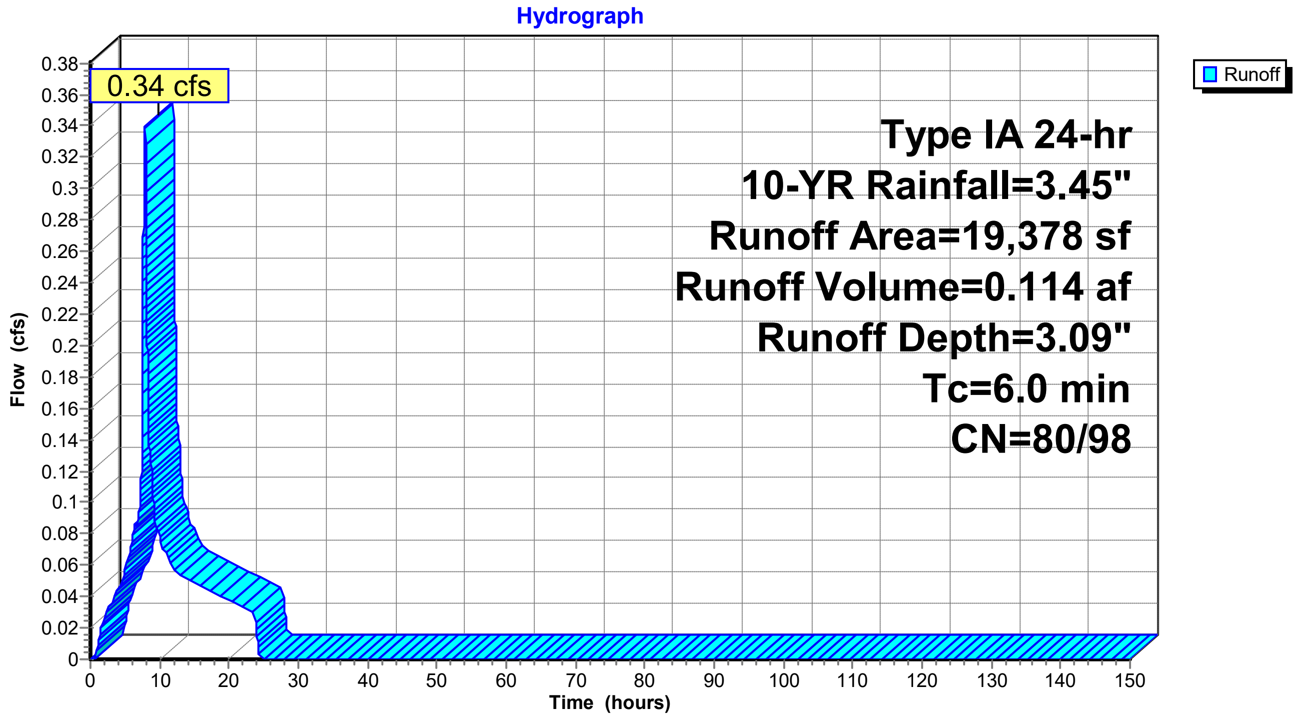
Runoff = 0.34 cfs @ 7.90 hrs, Volume= 0.114 af, Depth= 3.09"
Routed to Pond GP : Planter - Basin G

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	17,831	98	
*	1,547	80	
	19,378	97	Weighted Average
	1,547	80	7.98% Pervious Area
	17,831	98	92.02% Impervious Area

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

Subcatchment G: Post-Dev - Basin G



Summary for Subcatchment H: Post-Dev - Basin H

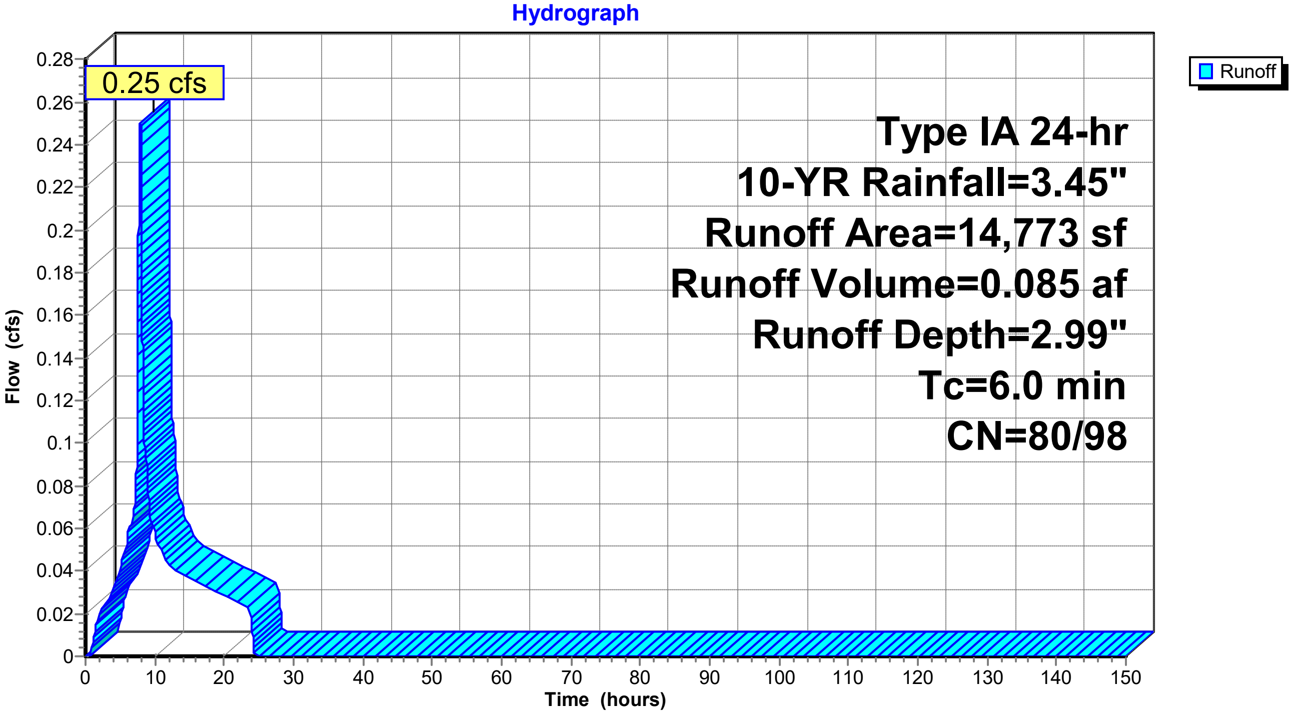
Runoff = 0.25 cfs @ 7.90 hrs, Volume= 0.085 af, Depth= 2.99"
Routed to Pond HP : Planter - Basin H

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	12,740	98	
*	2,033	80	
	14,773	96	Weighted Average
	2,033	80	13.76% Pervious Area
	12,740	98	86.24% Impervious Area

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

Subcatchment H: Post-Dev - Basin H



Summary for Pond AP: R-tank - Basin A

Inflow Area = 1.774 ac, 51.80% Impervious, Inflow Depth = 2.44" for 10-YR event
Inflow = 1.04 cfs @ 7.93 hrs, Volume= 0.360 af
Outflow = 0.24 cfs @ 10.74 hrs, Volume= 0.357 af, Atten= 77%, Lag= 168.3 min
Primary = 0.24 cfs @ 10.74 hrs, Volume= 0.357 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.08' @ 10.74 hrs Surf.Area= 0.032 ac Storage= 0.155 af

Plug-Flow detention time= 917.3 min calculated for 0.357 af (99% of inflow)
Center-of-Mass det. time= 910.6 min (1,622.0 - 711.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.047 af	**13.19'W x 107.22'L x 8.53'H Field A** 0.277 af Overall - 0.159 af Embedded = 0.118 af x 40.0% Voids
#2A	100.00'	0.151 af	**Ferguson R-Tank SD 10** x 308 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 308 Chambers in 7 Rows
		0.198 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.24 cfs @ 10.74 hrs HW=106.08' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.24 cfs of 15.51 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.06 cfs @ 11.83 fps)
  ├─**3=Weir** (Weir Controls 0.17 cfs @ 1.07 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond AP: R-tank - Basin A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

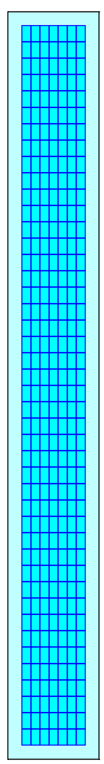
44 Chambers/Row x 2.35' Long = 103.22' Row Length +24.0" End Stone x 2 = 107.22' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

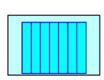
308 Chambers x 21.3 cf = 6,560.7 cf Chamber Storage
308 Chambers x 22.4 cf = 6,906.0 cf Displacement

12,064.4 cf Field - 6,906.0 cf Chambers = 5,158.4 cf Stone x 40.0% Voids = 2,063.4 cf Stone Storage

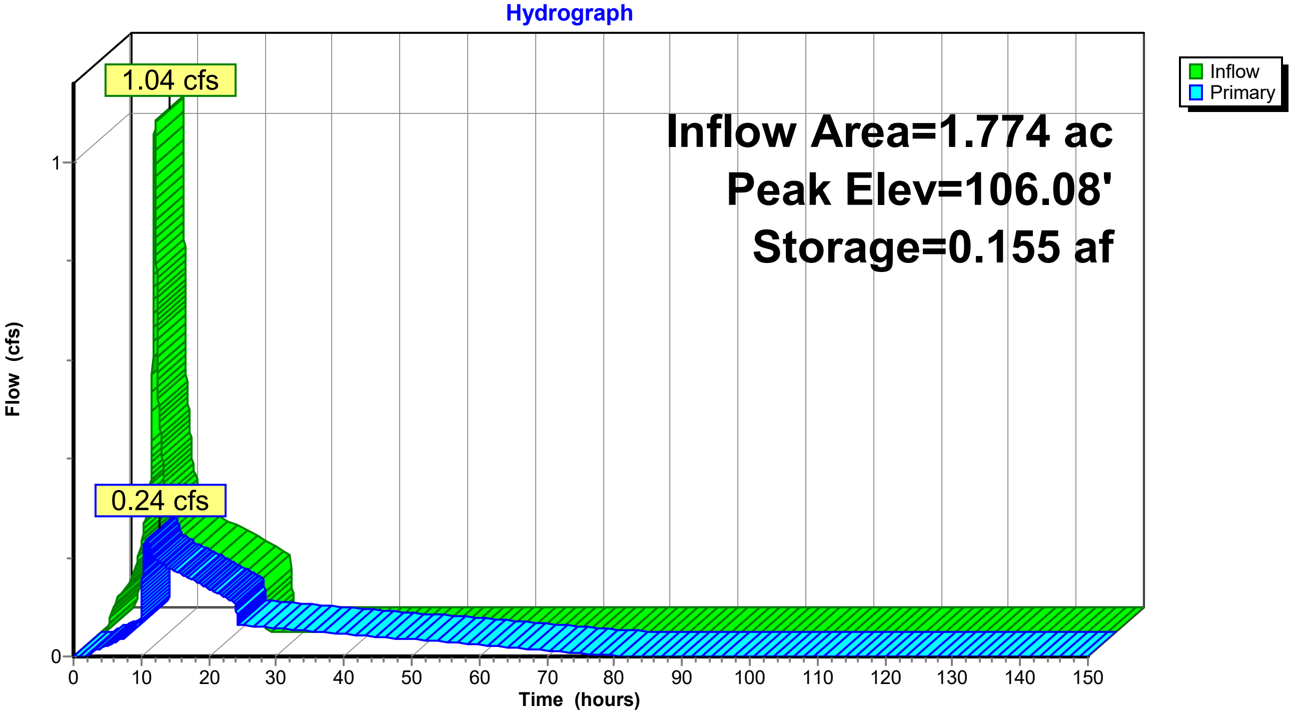
Chamber Storage + Stone Storage = 8,624.1 cf = 0.198 af
Overall Storage Efficiency = 71.5%
Overall System Size = 107.22' x 13.19' x 8.53'

308 Chambers
446.8 cy Field
191.1 cy Stone





Pond AP: R-tank - Basin A



Summary for Pond BP: R-tank - Basin B

Inflow Area = 2.909 ac, 57.33% Impervious, Inflow Depth = 2.53" for 10-YR event
Inflow = 1.77 cfs @ 7.92 hrs, Volume= 0.612 af
Outflow = 0.36 cfs @ 11.38 hrs, Volume= 0.606 af, Atten= 80%, Lag= 207.2 min
Primary = 0.36 cfs @ 11.38 hrs, Volume= 0.606 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.09' @ 11.38 hrs Surf.Area= 0.061 ac Storage= 0.293 af

Plug-Flow detention time= 1,186.5 min calculated for 0.606 af (99% of inflow)
Center-of-Mass det. time= 1,178.8 min (1,883.3 - 704.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.087 af	**13.19'W x 201.05'L x 8.53'H Field A** 0.519 af Overall - 0.303 af Embedded = 0.217 af x 40.0% Voids
#2A	100.00'	0.288 af	**Ferguson R-Tank SD 10** x 588 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 588 Chambers in 7 Rows
		0.374 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.2" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.36 cfs @ 11.38 hrs HW=106.09' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.36 cfs of 15.52 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.09 cfs @ 11.83 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.26 cfs @ 1.13 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond BP: R-tank - Basin B - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

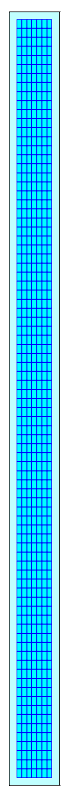
84 Chambers/Row x 2.35' Long = 197.05' Row Length +24.0" End Stone x 2 = 201.05' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

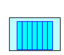
588 Chambers x 21.3 cf = 12,524.9 cf Chamber Storage
588 Chambers x 22.4 cf = 13,184.1 cf Displacement

22,622.9 cf Field - 13,184.1 cf Chambers = 9,438.8 cf Stone x 40.0% Voids = 3,775.5 cf Stone Storage

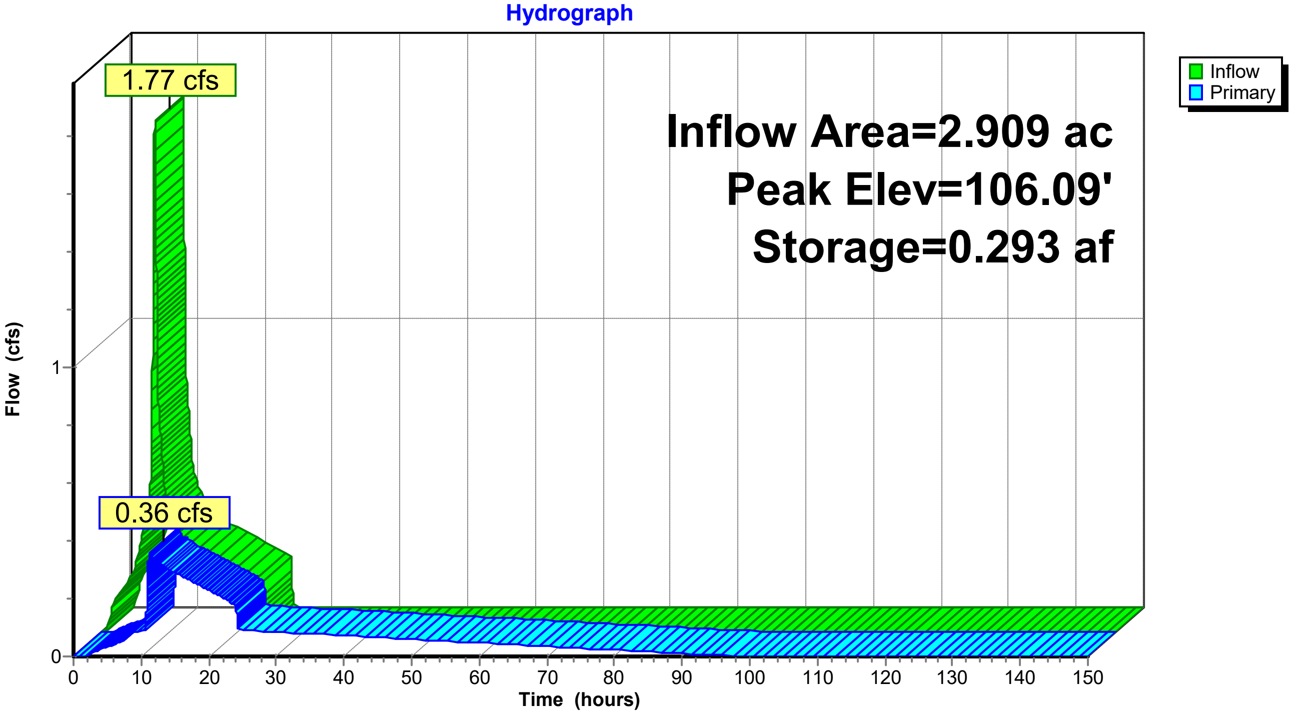
Chamber Storage + Stone Storage = 16,300.4 cf = 0.374 af
Overall Storage Efficiency = 72.1%
Overall System Size = 201.05' x 13.19' x 8.53'

588 Chambers
837.9 cy Field
349.6 cy Stone





Pond BP: R-tank - Basin B



Summary for Pond CP: R-tank - Basin C

Inflow Area = 1.282 ac, 80.45% Impervious, Inflow Depth = 2.90" for 10-YR event
Inflow = 0.91 cfs @ 7.91 hrs, Volume= 0.310 af
Outflow = 0.17 cfs @ 11.47 hrs, Volume= 0.306 af, Atten= 81%, Lag= 213.7 min
Primary = 0.17 cfs @ 11.47 hrs, Volume= 0.306 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.06' @ 11.47 hrs Surf.Area= 0.034 ac Storage= 0.161 af

Plug-Flow detention time= 1,476.2 min calculated for 0.306 af (99% of inflow)
Center-of-Mass det. time= 1,467.9 min (2,148.2 - 680.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.049 af	**13.19'W x 111.91'L x 8.53'H Field A** 0.289 af Overall - 0.166 af Embedded = 0.123 af x 40.0% Voids
#2A	100.00'	0.157 af	**Ferguson R-Tank SD 10** x 322 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 322 Chambers in 7 Rows
		0.207 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.8" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.17 cfs @ 11.47 hrs HW=106.06' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.17 cfs of 15.48 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.04 cfs @ 11.82 fps)
  ├─**3=Weir** (Weir Controls 0.13 cfs @ 0.97 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond CP: R-tank - Basin C - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

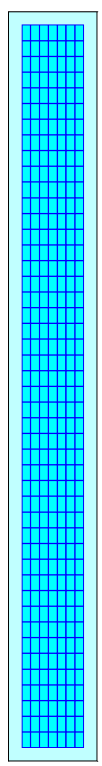
46 Chambers/Row x 2.35' Long = 107.91' Row Length +24.0" End Stone x 2 = 111.91' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

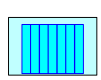
322 Chambers x 21.3 cf = 6,858.9 cf Chamber Storage
322 Chambers x 22.4 cf = 7,219.9 cf Displacement

12,592.3 cf Field - 7,219.9 cf Chambers = 5,372.5 cf Stone x 40.0% Voids = 2,149.0 cf Stone Storage

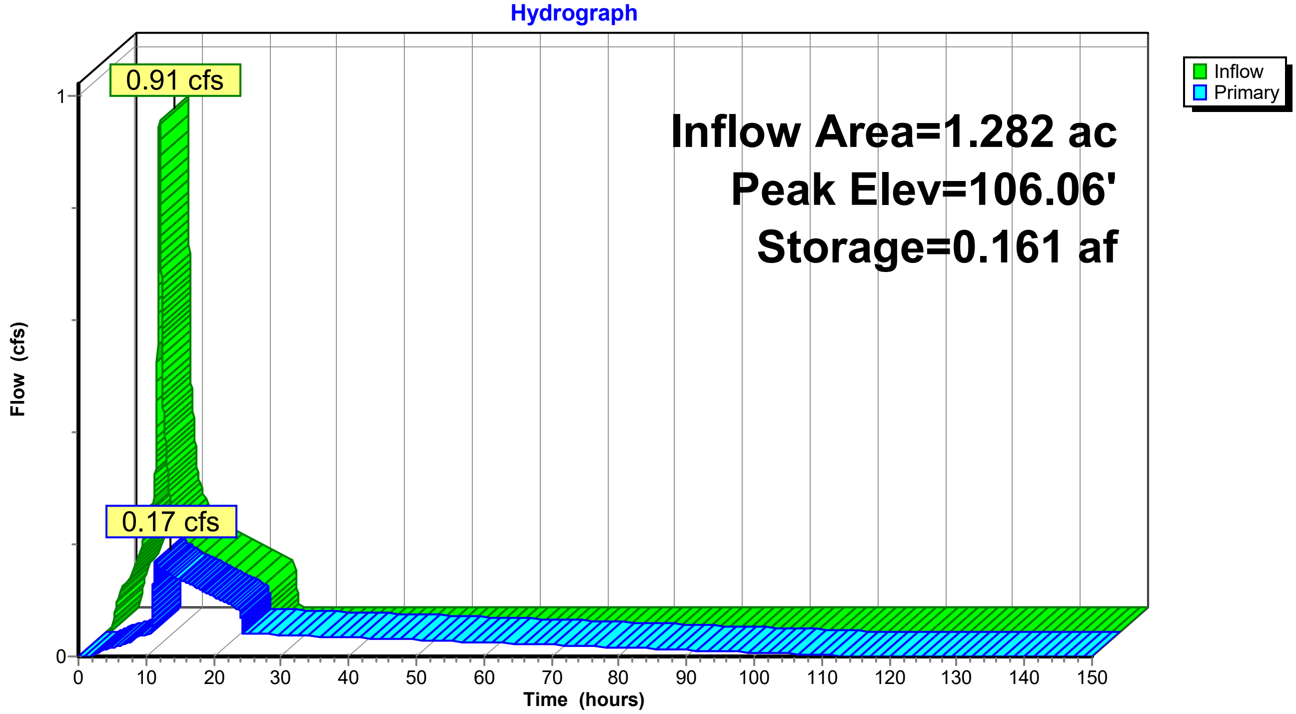
Chamber Storage + Stone Storage = 9,007.9 cf = 0.207 af
Overall Storage Efficiency = 71.5%
Overall System Size = 111.91' x 13.19' x 8.53'

322 Chambers
466.4 cy Field
199.0 cy Stone





Pond CP: R-tank - Basin C



Summary for Pond DP: R-tank - Basin D

Inflow Area = 2.183 ac, 76.16% Impervious, Inflow Depth = 2.83" for 10-YR event
Inflow = 1.51 cfs @ 7.91 hrs, Volume= 0.515 af
Outflow = 0.26 cfs @ 12.55 hrs, Volume= 0.509 af, Atten= 82%, Lag= 278.1 min
Primary = 0.26 cfs @ 12.55 hrs, Volume= 0.509 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.07' @ 12.55 hrs Surf.Area= 0.057 ac Storage= 0.275 af

Plug-Flow detention time= 1,599.9 min calculated for 0.509 af (99% of inflow)
Center-of-Mass det. time= 1,590.8 min (2,275.1 - 684.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.082 af	**13.19'W x 189.32'L x 8.53'H Field A** 0.489 af Overall - 0.285 af Embedded = 0.204 af x 40.0% Voids
#2A	100.00'	0.270 af	**Ferguson R-Tank SD 10** x 553 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 553 Chambers in 7 Rows
		0.352 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.26 cfs @ 12.55 hrs HW=106.07' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.26 cfs of 15.49 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.06 cfs @ 11.82 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.20 cfs @ 1.03 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond DP: R-tank - Basin D - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

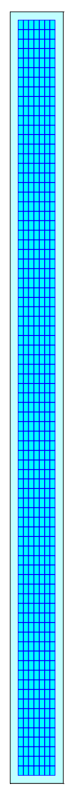
79 Chambers/Row x 2.35' Long = 185.32' Row Length +24.0" End Stone x 2 = 189.32' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

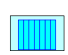
553 Chambers x 21.3 cf = 11,779.4 cf Chamber Storage
553 Chambers x 22.4 cf = 12,399.4 cf Displacement

21,303.1 cf Field - 12,399.4 cf Chambers = 8,903.7 cf Stone x 40.0% Voids = 3,561.5 cf Stone Storage

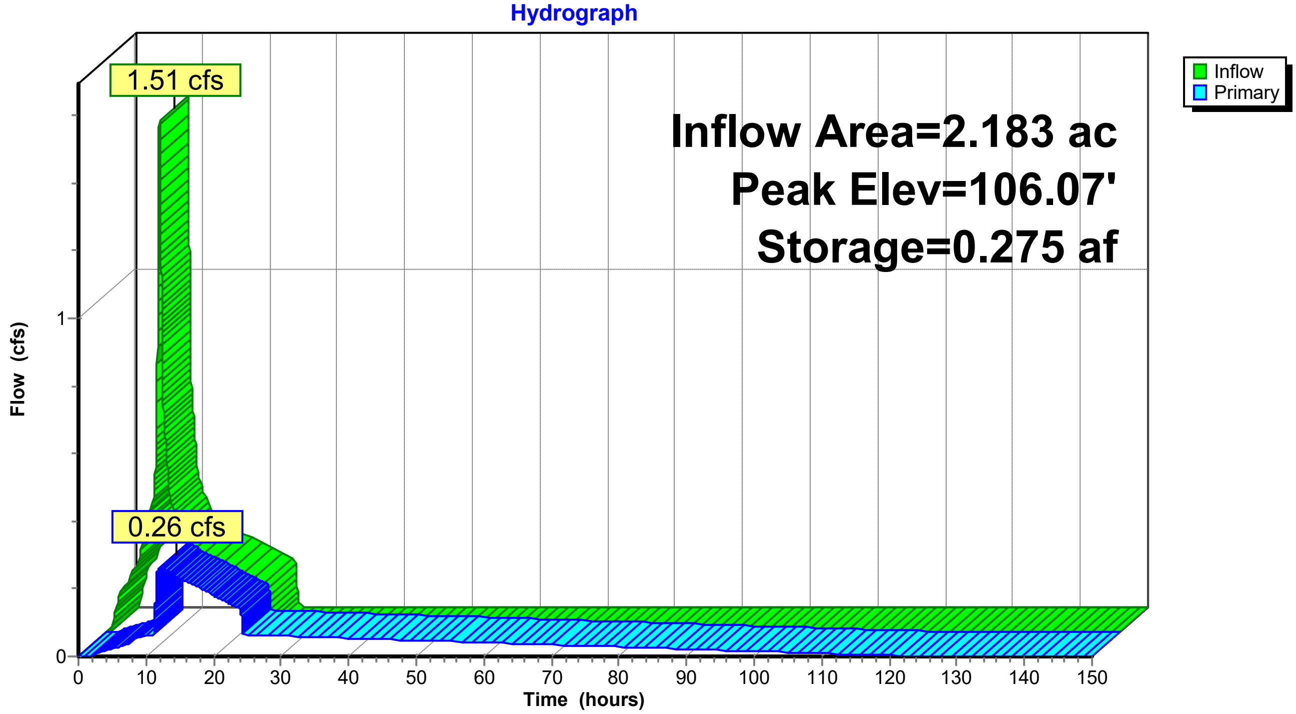
Chamber Storage + Stone Storage = 15,340.9 cf = 0.352 af
Overall Storage Efficiency = 72.0%
Overall System Size = 189.32' x 13.19' x 8.53'

553 Chambers
789.0 cy Field
329.8 cy Stone





Pond DP: R-tank - Basin D



Summary for Pond EP: R-tank - Basin E

Inflow Area = 1.629 ac, 74.48% Impervious, Inflow Depth = 2.80" for 10-YR event
Inflow = 1.12 cfs @ 7.91 hrs, Volume= 0.381 af
Outflow = 0.19 cfs @ 13.29 hrs, Volume= 0.328 af, Atten= 83%, Lag= 322.4 min
Primary = 0.19 cfs @ 13.29 hrs, Volume= 0.328 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.06' @ 13.29 hrs Surf.Area= 0.048 ac Storage= 0.230 af

Plug-Flow detention time= 2,429.1 min calculated for 0.328 af (86% of inflow)
Center-of-Mass det. time= 2,334.3 min (3,020.2 - 685.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.069 af	**13.19'W x 158.82'L x 8.53'H Field A** 0.410 af Overall - 0.238 af Embedded = 0.172 af x 40.0% Voids
#2A	100.00'	0.226 af	**Ferguson R-Tank SD 10** x 462 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 462 Chambers in 7 Rows
		0.295 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.6" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.19 cfs @ 13.29 hrs HW=106.06' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.19 cfs of 15.47 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.02 cfs @ 11.83 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.16 cfs @ 0.96 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond EP: R-tank - Basin E - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

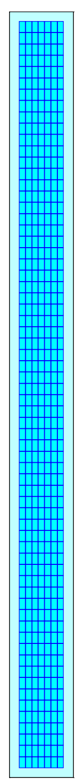
66 Chambers/Row x 2.35' Long = 154.82' Row Length +24.0" End Stone x 2 = 158.82' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

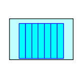
462 Chambers x 21.3 cf = 9,841.0 cf Chamber Storage
462 Chambers x 22.4 cf = 10,359.0 cf Displacement

17,871.6 cf Field - 10,359.0 cf Chambers = 7,512.6 cf Stone x 40.0% Voids = 3,005.0 cf Stone Storage

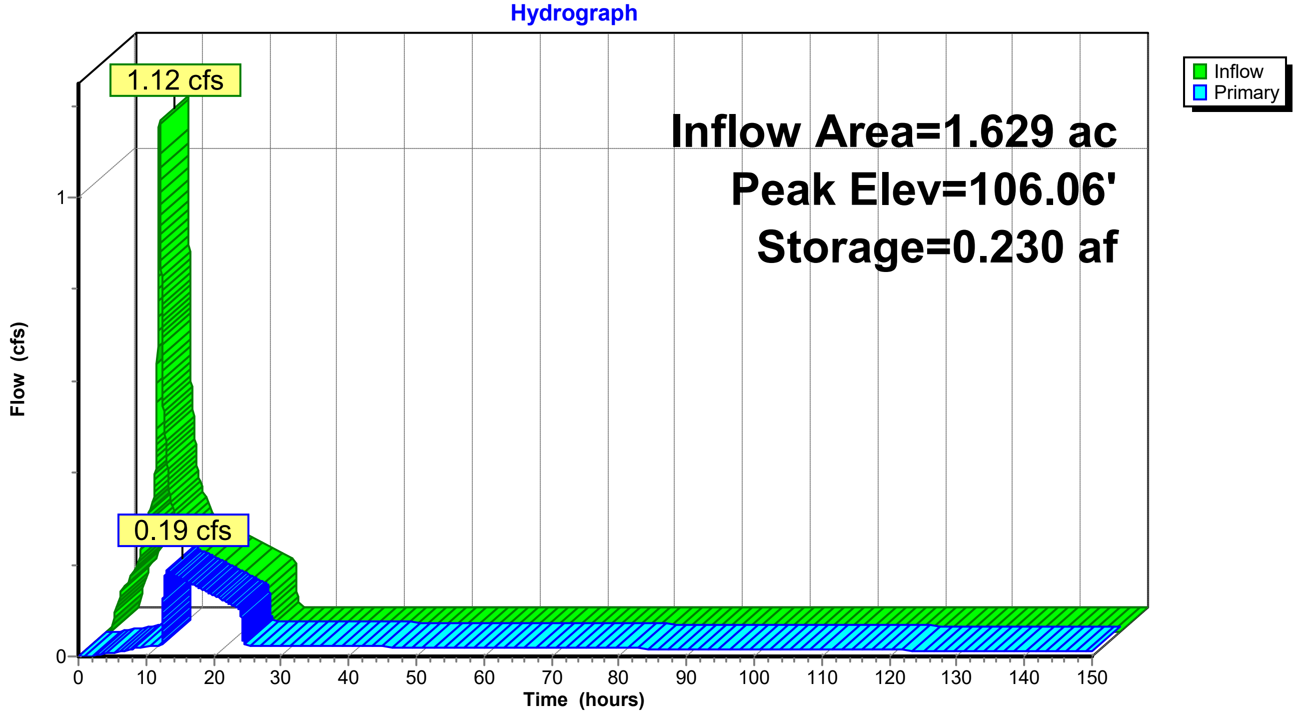
Chamber Storage + Stone Storage = 12,846.1 cf = 0.295 af
Overall Storage Efficiency = 71.9%
Overall System Size = 158.82' x 13.19' x 8.53'

462 Chambers
661.9 cy Field
278.2 cy Stone





Pond EP: R-tank - Basin E



Summary for Pond FP: R-tank - Basin F

Inflow Area = 0.998 ac, 82.99% Impervious, Inflow Depth = 2.94" for 10-YR event
Inflow = 0.72 cfs @ 7.91 hrs, Volume= 0.245 af
Outflow = 0.12 cfs @ 12.54 hrs, Volume= 0.242 af, Atten= 83%, Lag= 278.0 min
Primary = 0.12 cfs @ 12.54 hrs, Volume= 0.242 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.04' @ 12.54 hrs Surf.Area= 0.028 ac Storage= 0.133 af

Plug-Flow detention time= 1,626.2 min calculated for 0.242 af (99% of inflow)
Center-of-Mass det. time= 1,616.9 min (2,294.9 - 678.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.041 af	**13.19'W x 93.14'L x 8.53'H Field A** 0.241 af Overall - 0.137 af Embedded = 0.104 af x 40.0% Voids
#2A	100.00'	0.130 af	**Ferguson R-Tank SD 10** x 266 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 266 Chambers in 7 Rows
		0.172 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.7" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.12 cfs @ 12.54 hrs HW=106.04' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.12 cfs of 15.45 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.03 cfs @ 11.81 fps)
  ├─**3=Weir** (Weir Controls 0.09 cfs @ 0.87 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond FP: R-tank - Basin F - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

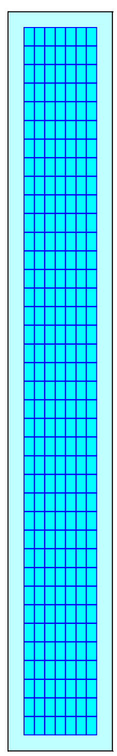
38 Chambers/Row x 2.35' Long = 89.14' Row Length +24.0" End Stone x 2 = 93.14' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

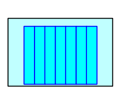
266 Chambers x 21.3 cf = 5,666.0 cf Chamber Storage
266 Chambers x 22.4 cf = 5,964.2 cf Displacement

10,480.7 cf Field - 5,964.2 cf Chambers = 4,516.4 cf Stone x 40.0% Voids = 1,806.6 cf Stone Storage

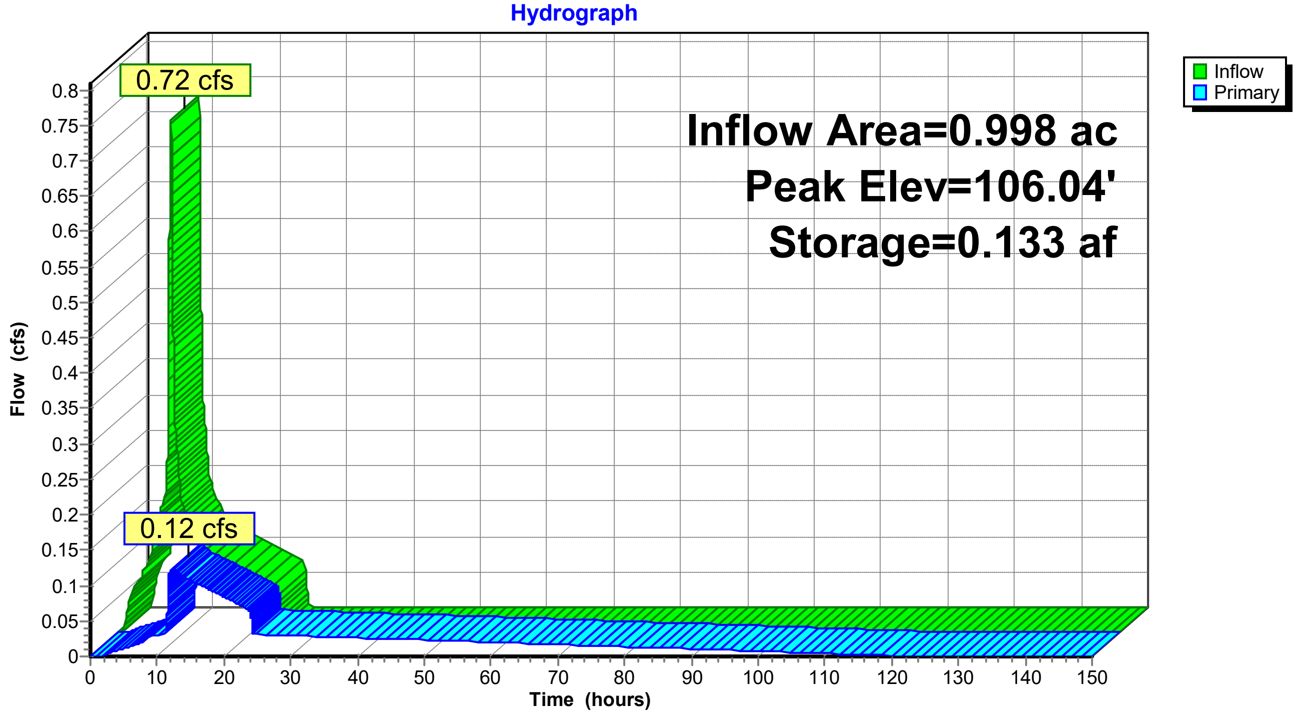
Chamber Storage + Stone Storage = 7,472.6 cf = 0.172 af
Overall Storage Efficiency = 71.3%
Overall System Size = 93.14' x 13.19' x 8.53'

266 Chambers
388.2 cy Field
167.3 cy Stone





Pond FP: R-tank - Basin F



Summary for Pond GP: Planter - Basin G

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 0.445 ac, 92.02% Impervious, Inflow Depth = 3.09" for 10-YR event
Inflow = 0.34 cfs @ 7.90 hrs, Volume= 0.114 af
Outflow = 0.06 cfs @ 12.54 hrs, Volume= 0.113 af, Atten= 83%, Lag= 278.3 min
Primary = 0.06 cfs @ 12.54 hrs, Volume= 0.113 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.87' @ 12.54 hrs Surf.Area= 2,320 sf Storage= 2,862 cf

Plug-Flow detention time= 2,148.7 min calculated for 0.113 af (99% of inflow)
Center-of-Mass det. time= 2,137.6 min (2,808.0 - 670.4)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	2,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,856 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,640 cf Overall x 40.0% Voids
		4,176 cf	Total Available Storage

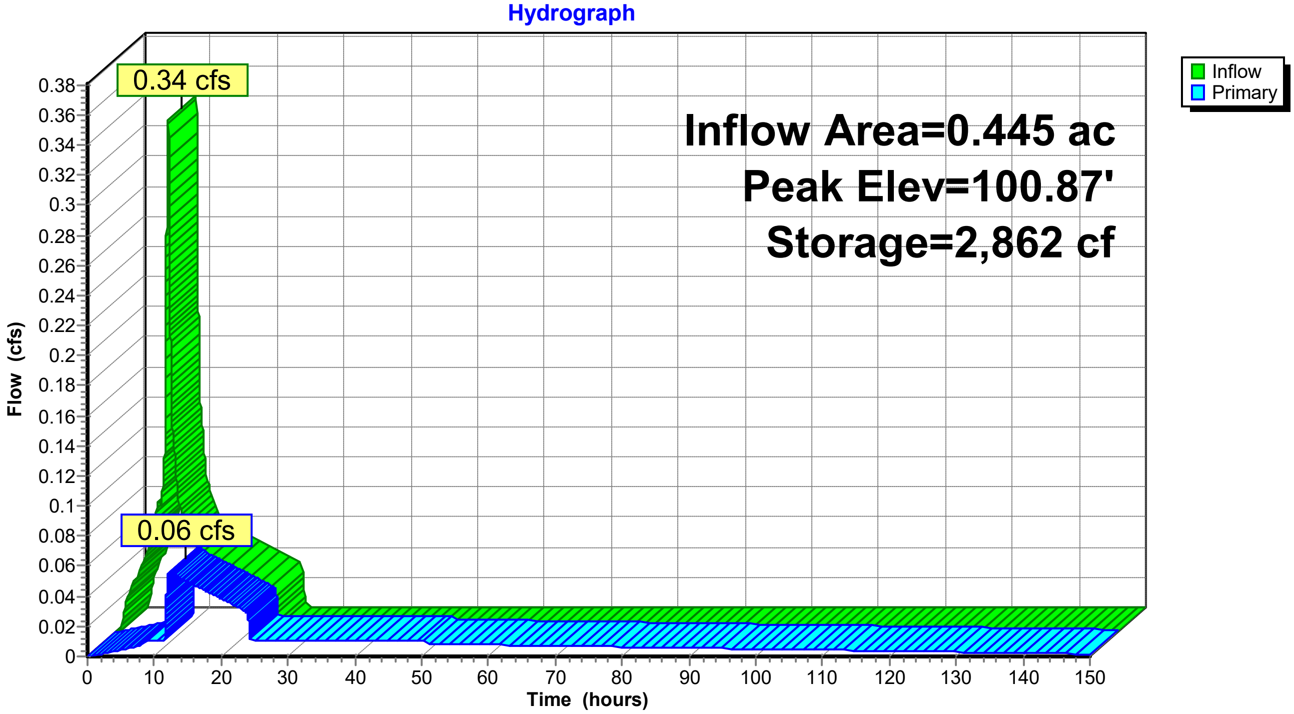
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	1,160	0	0
102.00	1,160	2,320	2,320

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	1,160	0	0
98.25	1,160	4,640	4,640

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.84'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.06 cfs @ 12.54 hrs HW=100.87' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.06 cfs of 16.27 cfs potential flow)
  ├─**3=Orifice A** (Orifice Controls 0.01 cfs @ 12.37 fps)
  │ ├─**2=Beehive OF** (Controls 0.00 cfs)
  │ └─**4=Underdrain** (Passes 0.01 cfs of 2.39 cfs potential flow)
  └─**5=Orifice B** (Weir Controls 0.05 cfs @ 0.54 fps)

Pond GP: Planter - Basin G



Summary for Pond HP: Planter - Basin H

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 0.339 ac, 86.24% Impervious, Inflow Depth = 2.99" for 10-YR event
Inflow = 0.25 cfs @ 7.90 hrs, Volume= 0.085 af
Outflow = 0.05 cfs @ 11.17 hrs, Volume= 0.085 af, Atten= 81%, Lag= 195.7 min
Primary = 0.05 cfs @ 11.17 hrs, Volume= 0.085 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.98' @ 11.17 hrs Surf.Area= 1,476 sf Storage= 1,907 cf

Plug-Flow detention time= 1,501.0 min calculated for 0.085 af (100% of inflow)
Center-of-Mass det. time= 1,500.8 min (2,176.0 - 675.2)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,476 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,181 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 2,952 cf Overall x 40.0% Voids
		2,657 cf	Total Available Storage

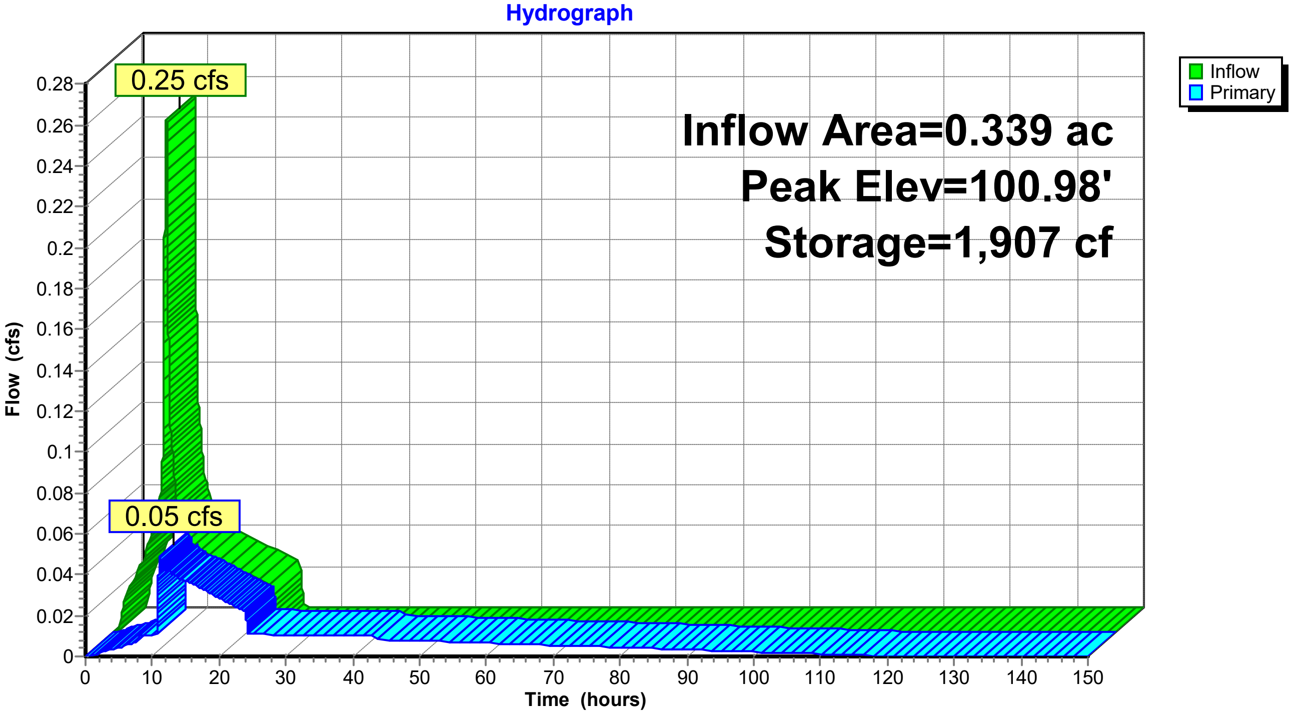
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	738	0	0
102.00	738	1,476	1,476

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	738	0	0
98.25	738	2,952	2,952

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.96'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.05 cfs @ 11.17 hrs HW=100.98' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.05 cfs of 16.43 cfs potential flow)
 ├─**3=Orifice A** (Orifice Controls 0.01 cfs @ 12.48 fps)
 │ ├─**2=Beehive OF** (Controls 0.00 cfs)
 │ └─**4=Underdrain** (Passes 0.01 cfs of 2.41 cfs potential flow)
 └─**5=Orifice B** (Weir Controls 0.04 cfs @ 0.50 fps)

Pond HP: Planter - Basin H

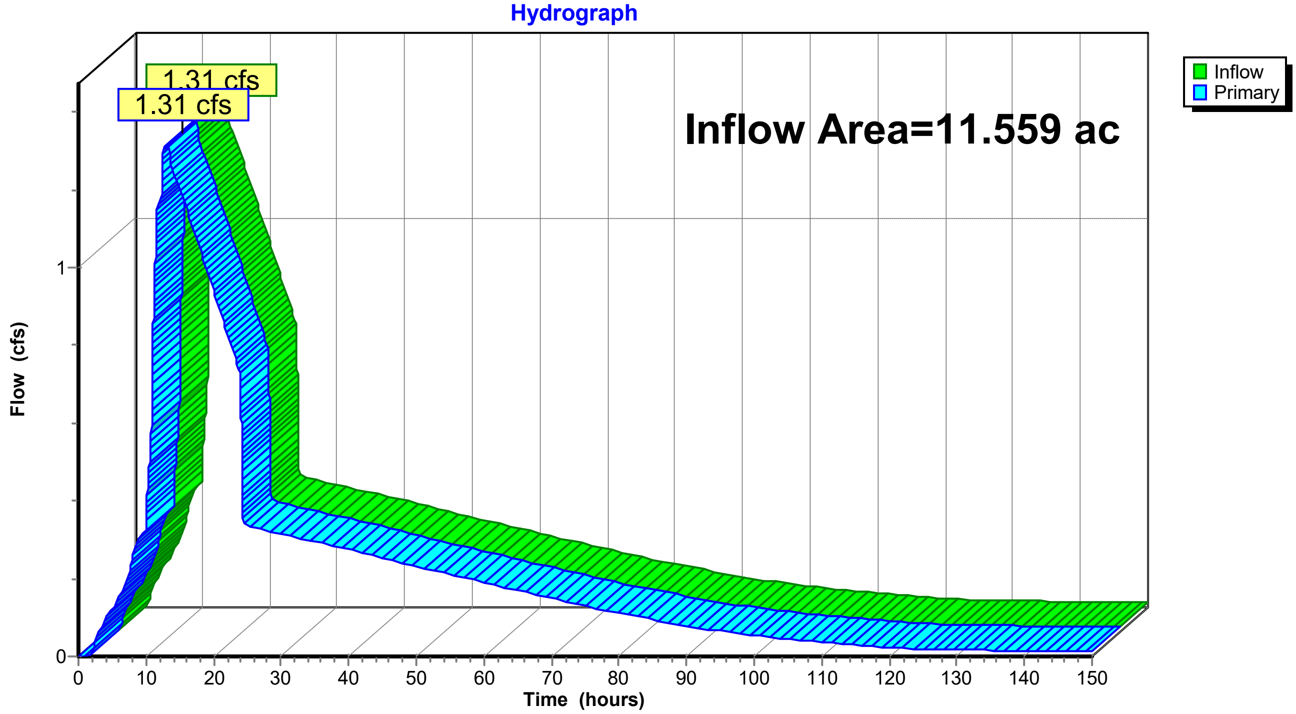


Summary for Link PR: Combined - PostDev

Inflow Area =	11.559 ac, 69.42% Impervious, Inflow Depth > 2.64"	for 10-YR event		
Inflow =	1.31 cfs @ 13.25 hrs, Volume=	2.545 af		
Primary =	1.31 cfs @ 13.25 hrs, Volume=	2.545 af, Atten= 0%, Lag= 0.0 min		

Primary outflow = Inflow, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs

Link PR: Combined - PostDev



Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A: Post-Dev - Basin A Runoff Area=77,258 sf 51.80% Impervious Runoff Depth=2.84"
Tc=6.0 min CN=80/98 Runoff=1.22 cfs 0.420 af

Subcatchment B: Post-Dev - Basin B Runoff Area=126,737 sf 57.33% Impervious Runoff Depth=2.94"
Tc=6.0 min CN=80/98 Runoff=2.07 cfs 0.712 af

Subcatchment C: Post-Dev - Basin C Runoff Area=55,842 sf 80.45% Impervious Runoff Depth=3.33"
Tc=6.0 min CN=80/98 Runoff=1.05 cfs 0.356 af

Subcatchment D: Post-Dev - Basin D Runoff Area=95,094 sf 76.16% Impervious Runoff Depth=3.26"
Tc=6.0 min CN=80/98 Runoff=1.74 cfs 0.593 af

Subcatchment E: Post-Dev - Basin E Runoff Area=70,966 sf 74.48% Impervious Runoff Depth=3.23"
Tc=6.0 min CN=80/98 Runoff=1.29 cfs 0.439 af

Subcatchment EX: Pre-Dev Runoff Area=508,228 sf 0.00% Impervious Runoff Depth=1.26"
Tc=10.0 min CN=70/0 Runoff=2.54 cfs 1.228 af

Subcatchment F: Post-Dev - Basin F Runoff Area=43,479 sf 82.99% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=80/98 Runoff=0.83 cfs 0.281 af

Subcatchment G: Post-Dev - Basin G Runoff Area=19,378 sf 92.02% Impervious Runoff Depth=3.53"
Tc=6.0 min CN=80/98 Runoff=0.39 cfs 0.131 af

Subcatchment H: Post-Dev - Basin H Runoff Area=14,773 sf 86.24% Impervious Runoff Depth=3.43"
Tc=6.0 min CN=80/98 Runoff=0.29 cfs 0.097 af

Pond AP: R-tank - Basin A Peak Elev=106.13' Storage=0.156 af Inflow=1.22 cfs 0.420 af
Outflow=0.37 cfs 0.417 af

Pond BP: R-tank - Basin B Peak Elev=106.14' Storage=0.296 af Inflow=2.07 cfs 0.712 af
Outflow=0.53 cfs 0.706 af

Pond CP: R-tank - Basin C Peak Elev=106.09' Storage=0.162 af Inflow=1.05 cfs 0.356 af
Outflow=0.25 cfs 0.352 af

Pond DP: R-tank - Basin D Peak Elev=106.11' Storage=0.277 af Inflow=1.74 cfs 0.593 af
Outflow=0.40 cfs 0.587 af

Pond EP: R-tank - Basin E Peak Elev=106.08' Storage=0.231 af Inflow=1.29 cfs 0.439 af
Outflow=0.26 cfs 0.386 af

Pond FP: R-tank - Basin F Peak Elev=106.07' Storage=0.134 af Inflow=0.83 cfs 0.281 af
Outflow=0.19 cfs 0.278 af

Pond GP: Planter - Basin G Peak Elev=100.88' Storage=2,873 cf Inflow=0.39 cfs 0.131 af
Outflow=0.08 cfs 0.129 af

Pond HP: Planter - Basin H Peak Elev=100.99' Storage=1,913 cf Inflow=0.29 cfs 0.097 af
Outflow=0.07 cfs 0.097 af

Link PR: Combined - PostDev Inflow=1.89 cfs 2.951 af
Primary=1.89 cfs 2.951 af

Total Runoff Area = 23.227 ac Runoff Volume = 4.257 af Average Runoff Depth = 2.20"
65.45% Pervious = 15.202 ac 34.55% Impervious = 8.024 ac

Summary for Subcatchment A: Post-Dev - Basin A

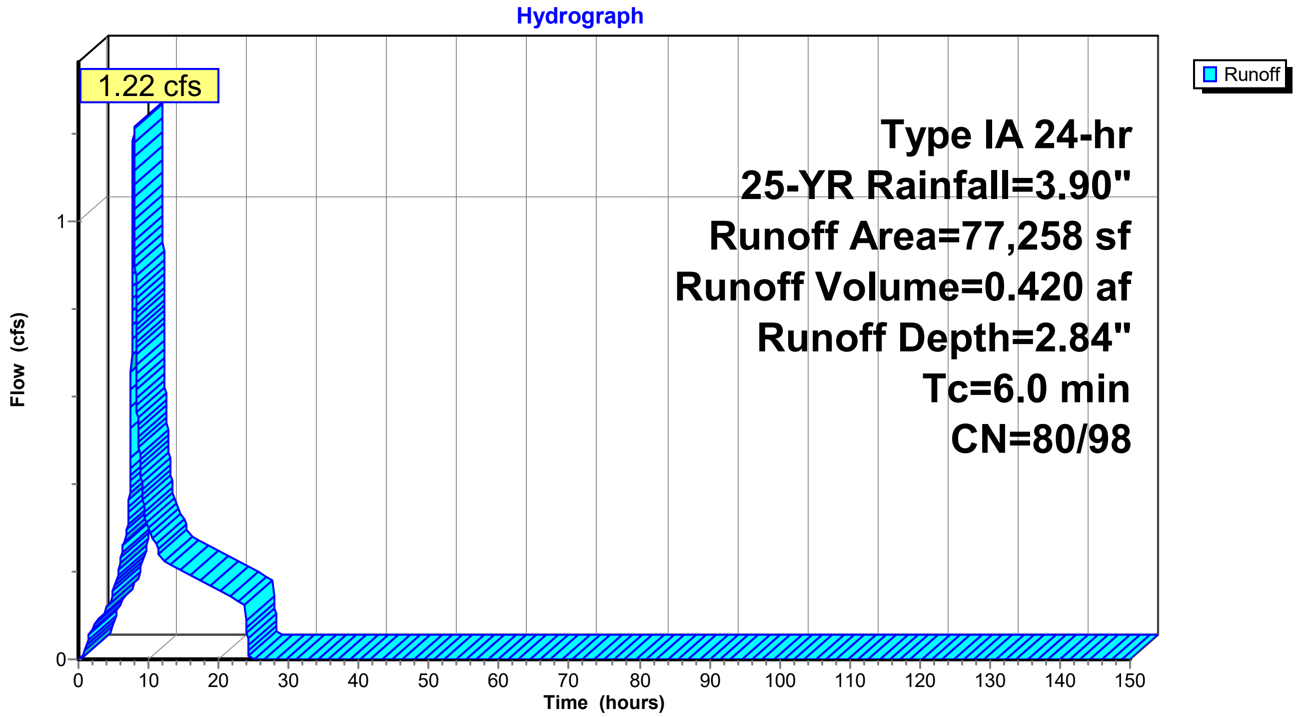
Runoff = 1.22 cfs @ 7.93 hrs, Volume= 0.420 af, Depth= 2.84"
Routed to Pond AP : R-tank - Basin A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	40,023	98	
*	37,235	80	
	77,258	89	Weighted Average
	37,235	80	48.20% Pervious Area
	40,023	98	51.80% Impervious Area

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

Subcatchment A: Post-Dev - Basin A



Summary for Subcatchment B: Post-Dev - Basin B

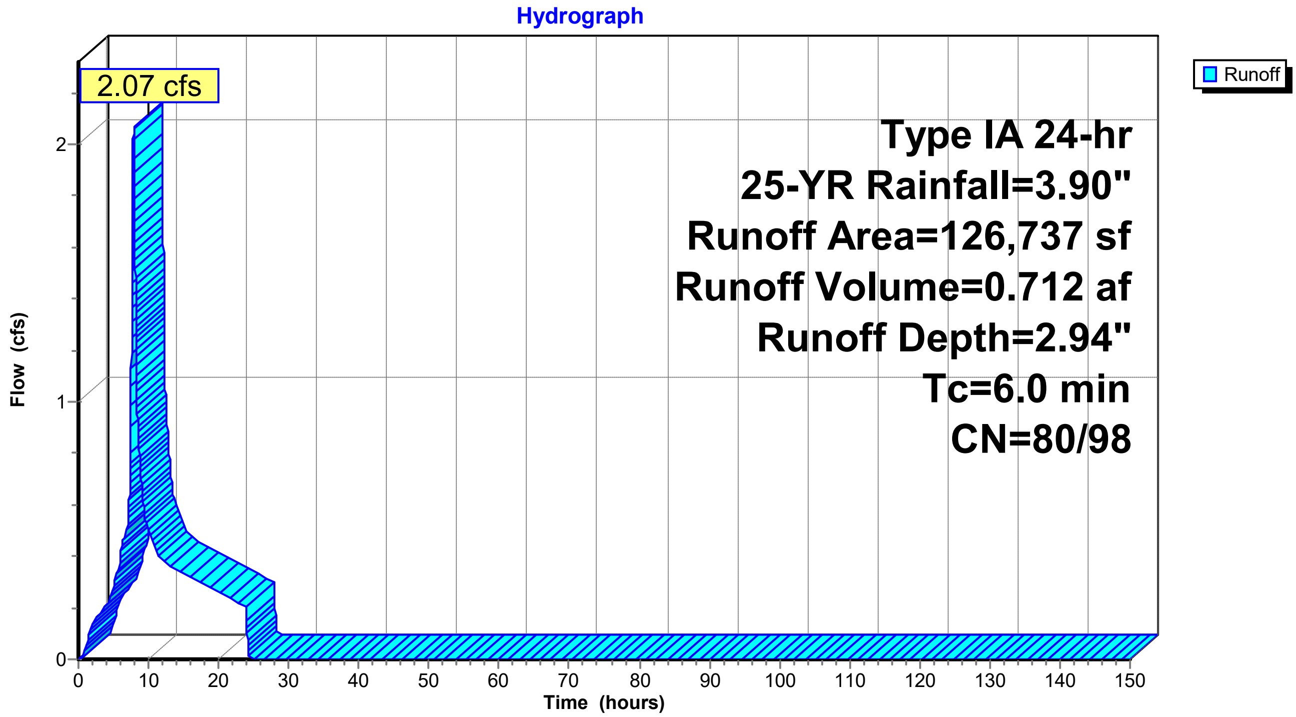
Runoff = 2.07 cfs @ 7.92 hrs, Volume= 0.712 af, Depth= 2.94"
Routed to Pond BP : R-tank - Basin B

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	72,652	98	
*	54,085	80	
	126,737	90	Weighted Average
	54,085	80	42.67% Pervious Area
	72,652	98	57.33% Impervious Area

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

Subcatchment B: Post-Dev - Basin B



Summary for Subcatchment C: Post-Dev - Basin C

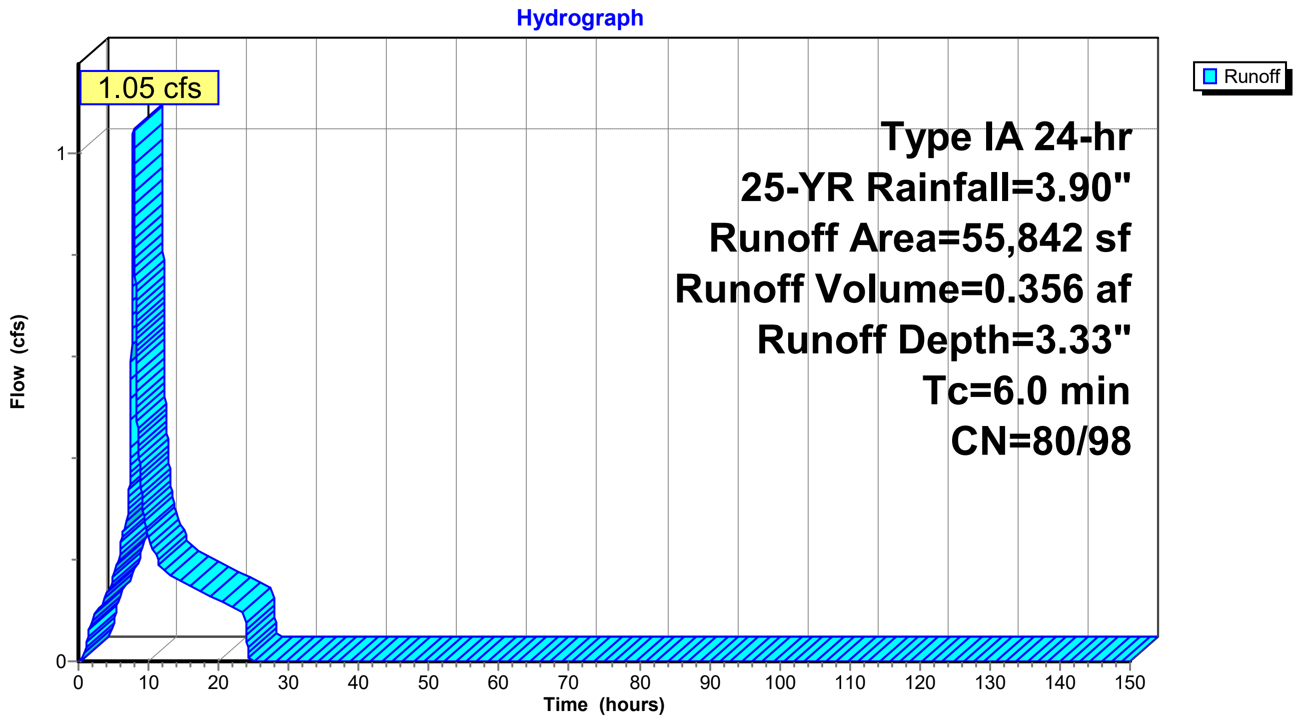
Runoff = 1.05 cfs @ 7.91 hrs, Volume= 0.356 af, Depth= 3.33"
Routed to Pond CP : R-tank - Basin C

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	44,926	98	
*	10,916	80	
	55,842	94	Weighted Average
	10,916	80	19.55% Pervious Area
	44,926	98	80.45% Impervious Area

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

Subcatchment C: Post-Dev - Basin C



Summary for Subcatchment D: Post-Dev - Basin D

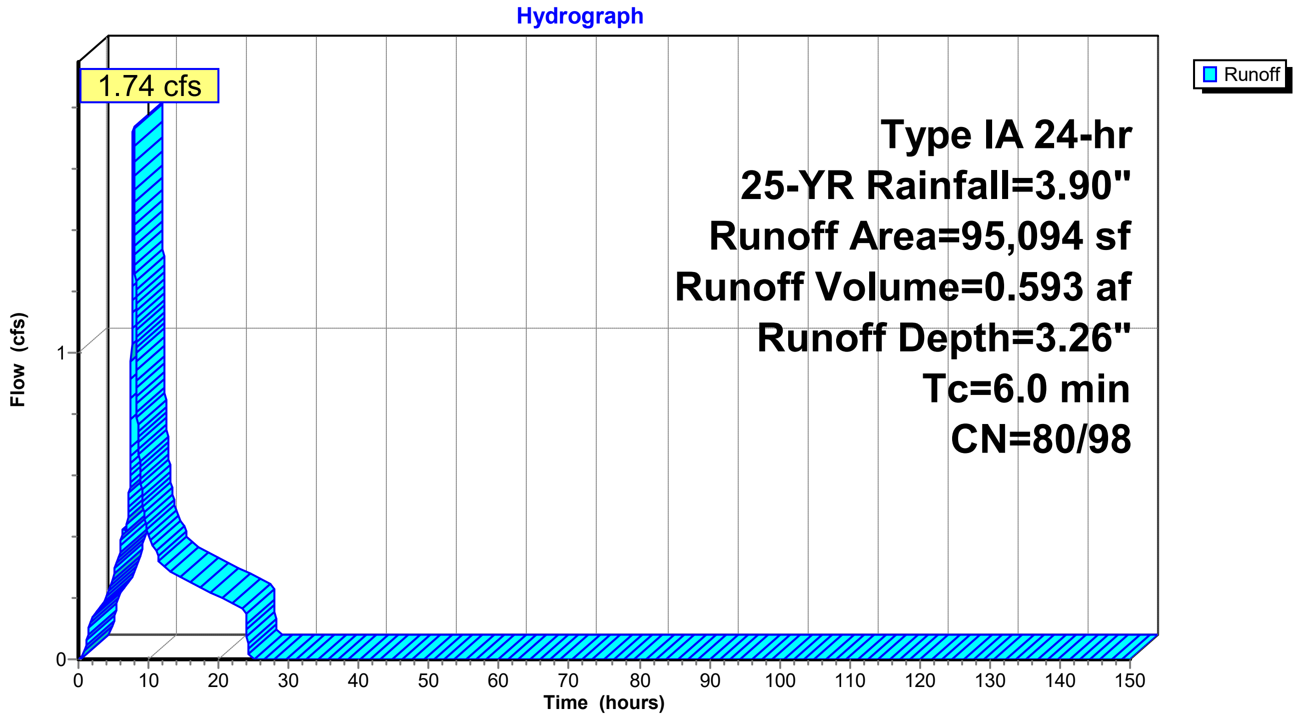
Runoff = 1.74 cfs @ 7.91 hrs, Volume= 0.593 af, Depth= 3.26"
Routed to Pond DP : R-tank - Basin D

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	72,428	98	
*	22,666	80	
	95,094	94	Weighted Average
	22,666	80	23.84% Pervious Area
	72,428	98	76.16% Impervious Area

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

Subcatchment D: Post-Dev - Basin D



Summary for Subcatchment E: Post-Dev - Basin E

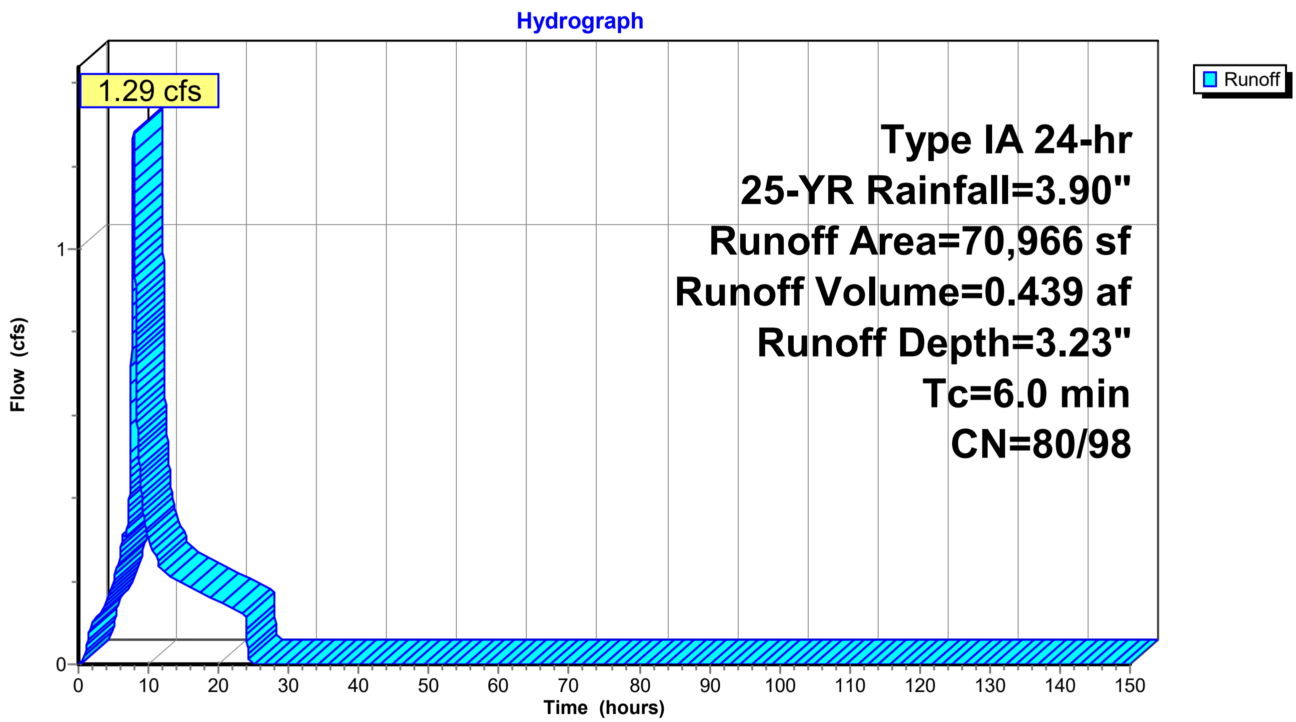
Runoff = 1.29 cfs @ 7.91 hrs, Volume= 0.439 af, Depth= 3.23"
Routed to Pond EP : R-tank - Basin E

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	52,854	98	
*	18,112	80	
	70,966	93	Weighted Average
	18,112	80	25.52% Pervious Area
	52,854	98	74.48% Impervious Area

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

Subcatchment E: Post-Dev - Basin E



Summary for Subcatchment EX: Pre-Dev

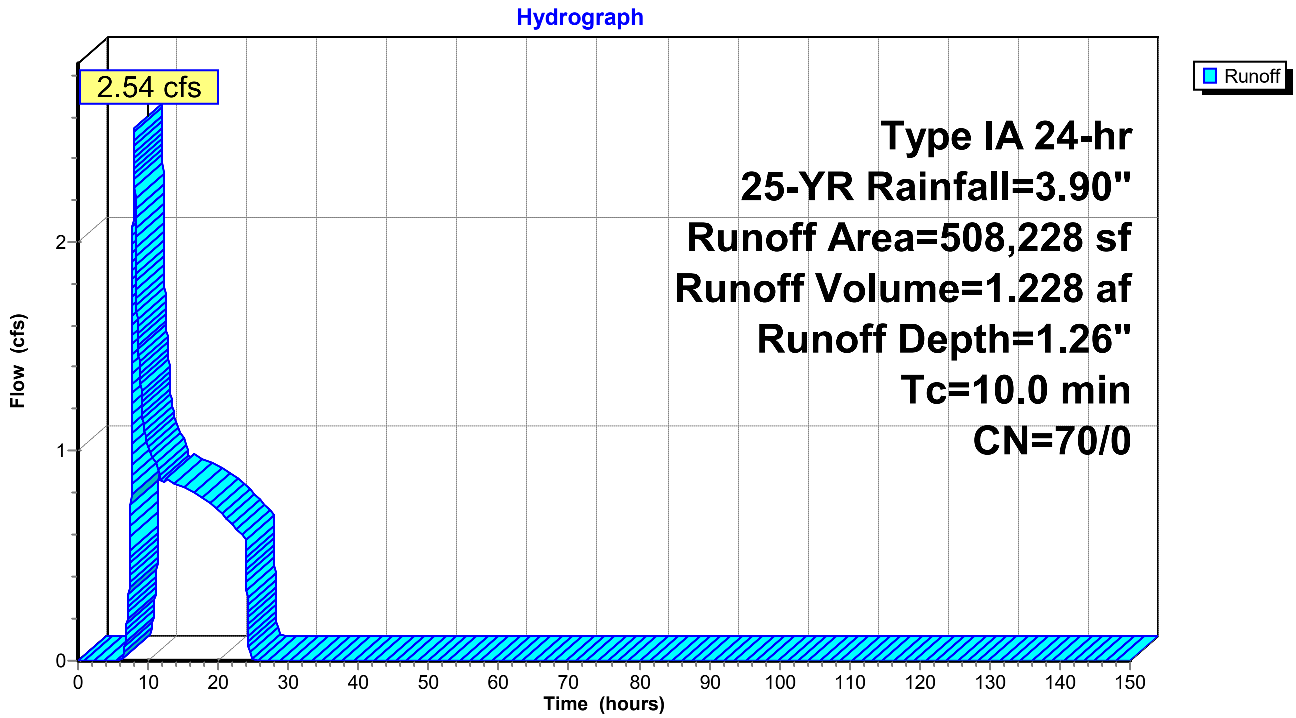
Runoff = 2.54 cfs @ 8.00 hrs, Volume= 1.228 af, Depth= 1.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	508,228	70	
	508,228	70	100.00% Pervious Area

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

Subcatchment EX: Pre-Dev



Summary for Subcatchment F: Post-Dev - Basin F

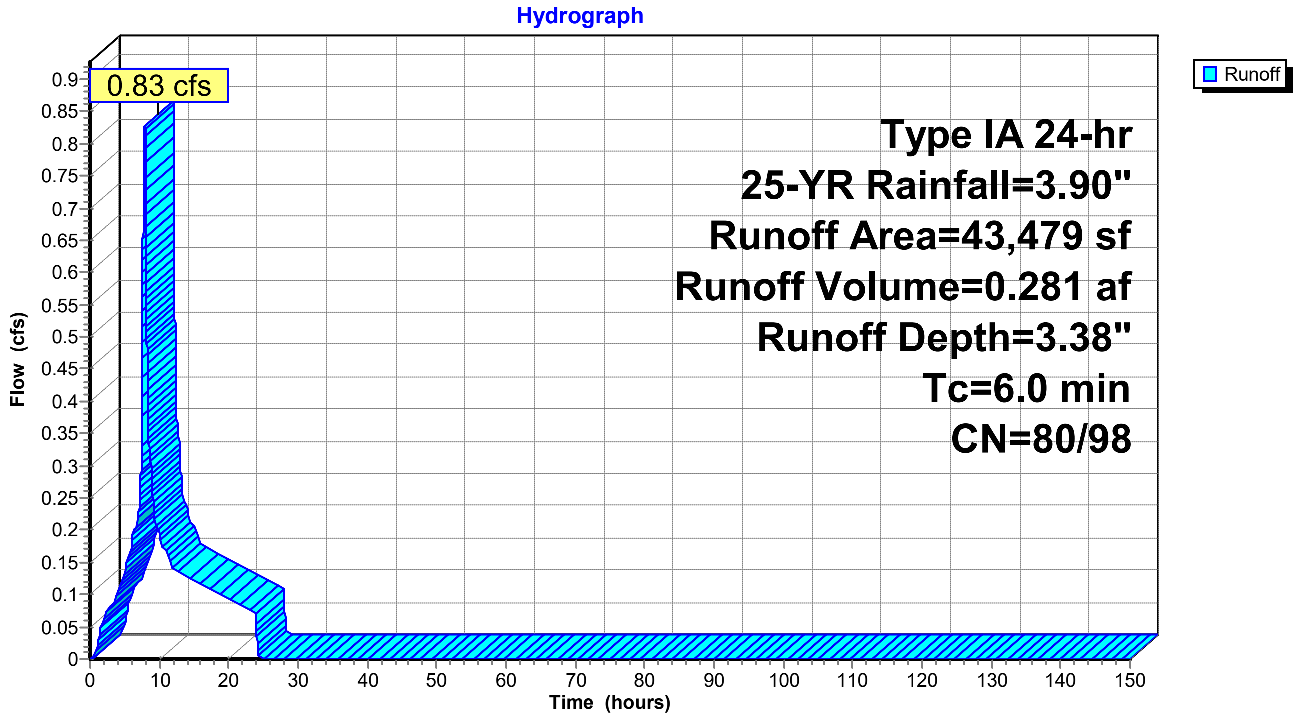
Runoff = 0.83 cfs @ 7.90 hrs, Volume= 0.281 af, Depth= 3.38"
Routed to Pond FP : R-tank - Basin F

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	36,082	98	
*	7,397	80	
	43,479	95	Weighted Average
	7,397	80	17.01% Pervious Area
	36,082	98	82.99% Impervious Area

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

Subcatchment F: Post-Dev - Basin F



Summary for Subcatchment G: Post-Dev - Basin G

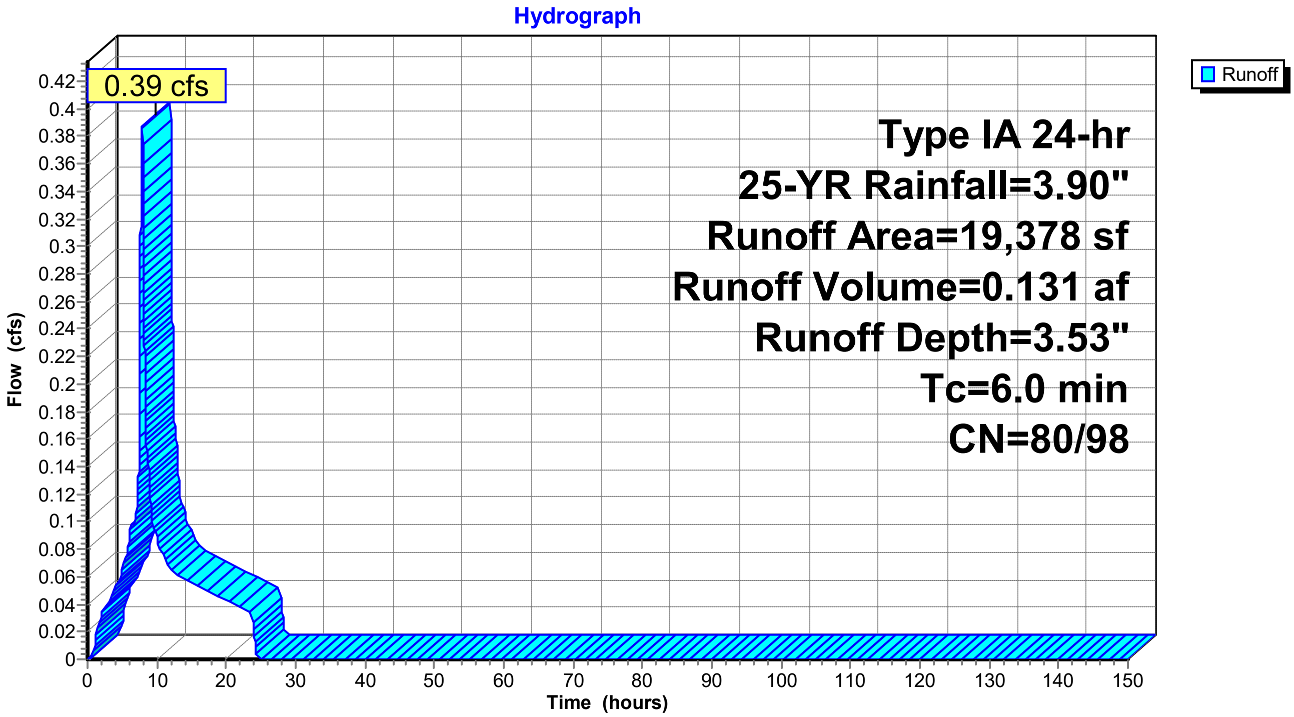
Runoff = 0.39 cfs @ 7.90 hrs, Volume= 0.131 af, Depth= 3.53"
Routed to Pond GP : Planter - Basin G

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	17,831	98	
*	1,547	80	
	19,378	97	Weighted Average
	1,547	80	7.98% Pervious Area
	17,831	98	92.02% Impervious Area

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

Subcatchment G: Post-Dev - Basin G



Summary for Subcatchment H: Post-Dev - Basin H

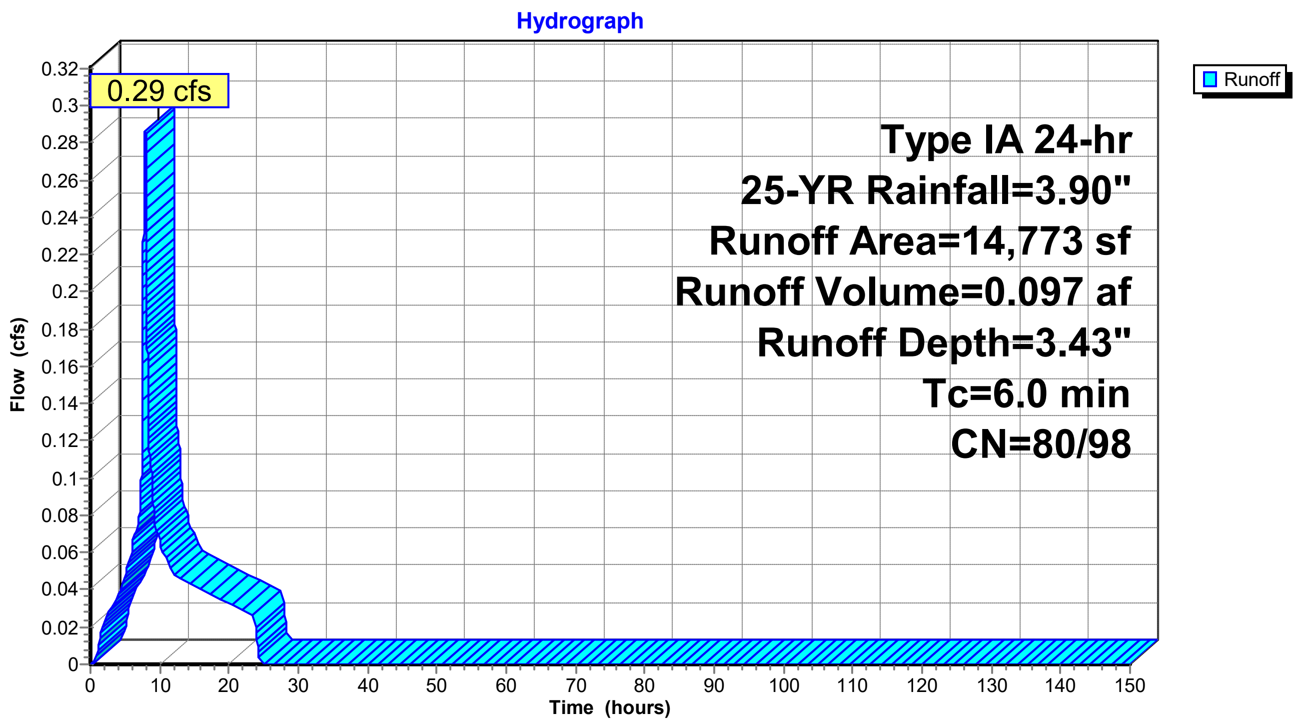
Runoff = 0.29 cfs @ 7.90 hrs, Volume= 0.097 af, Depth= 3.43"
Routed to Pond HP : Planter - Basin H

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	12,740	98	
*	2,033	80	
	14,773	96	Weighted Average
	2,033	80	13.76% Pervious Area
	12,740	98	86.24% Impervious Area

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

Subcatchment H: Post-Dev - Basin H



Summary for Pond AP: R-tank - Basin A

Inflow Area = 1.774 ac, 51.80% Impervious, Inflow Depth = 2.84" for 25-YR event
Inflow = 1.22 cfs @ 7.93 hrs, Volume= 0.420 af
Outflow = 0.37 cfs @ 9.17 hrs, Volume= 0.417 af, Atten= 70%, Lag= 74.5 min
Primary = 0.37 cfs @ 9.17 hrs, Volume= 0.417 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.13' @ 9.17 hrs Surf.Area= 0.032 ac Storage= 0.156 af

Plug-Flow detention time= 796.0 min calculated for 0.417 af (99% of inflow)
Center-of-Mass det. time= 790.6 min (1,498.1 - 707.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.047 af	**13.19'W x 107.22'L x 8.53'H Field A** 0.277 af Overall - 0.159 af Embedded = 0.118 af x 40.0% Voids
#2A	100.00'	0.151 af	**Ferguson R-Tank SD 10** x 308 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 308 Chambers in 7 Rows
		0.198 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.37 cfs @ 9.17 hrs HW=106.13' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.37 cfs of 15.58 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.06 cfs @ 11.88 fps)
  ├─**3=Weir** (Weir Controls 0.31 cfs @ 1.31 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond AP: R-tank - Basin A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

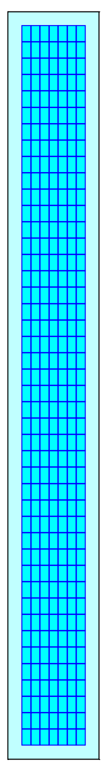
44 Chambers/Row x 2.35' Long = 103.22' Row Length +24.0" End Stone x 2 = 107.22' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

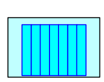
308 Chambers x 21.3 cf = 6,560.7 cf Chamber Storage
308 Chambers x 22.4 cf = 6,906.0 cf Displacement

12,064.4 cf Field - 6,906.0 cf Chambers = 5,158.4 cf Stone x 40.0% Voids = 2,063.4 cf Stone Storage

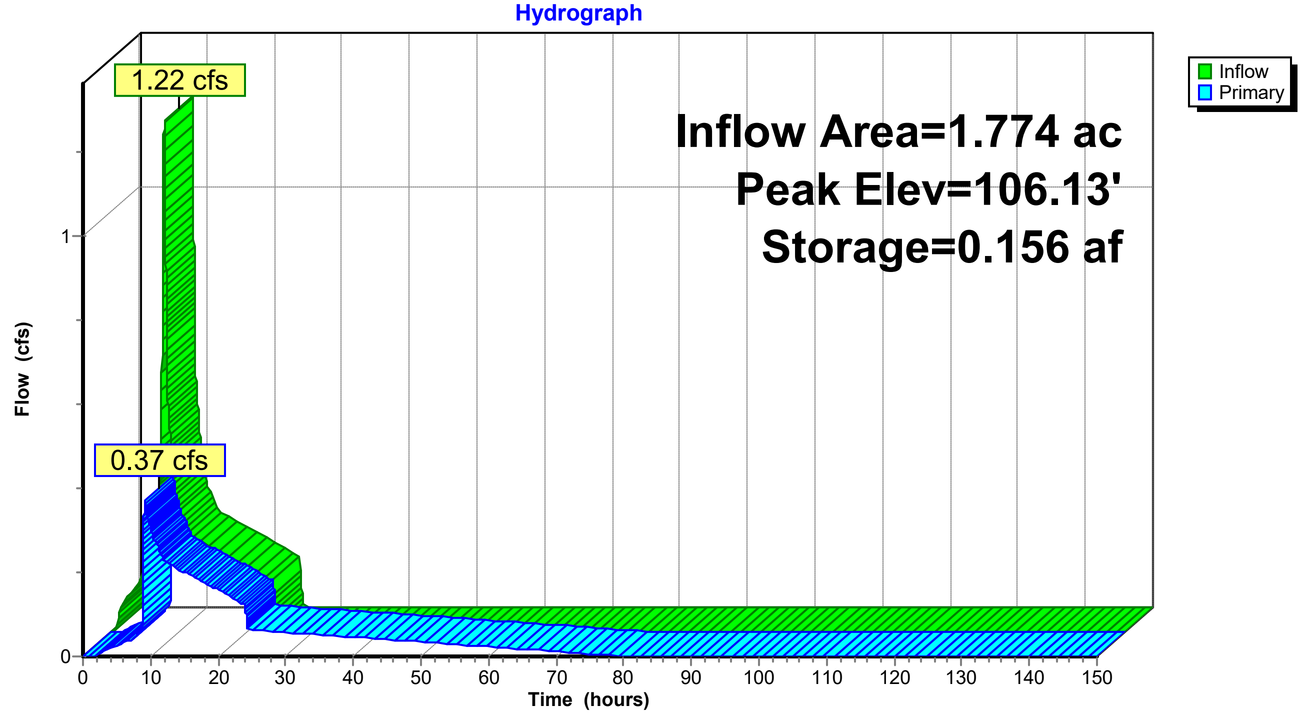
Chamber Storage + Stone Storage = 8,624.1 cf = 0.198 af
Overall Storage Efficiency = 71.5%
Overall System Size = 107.22' x 13.19' x 8.53'

308 Chambers
446.8 cy Field
191.1 cy Stone





Pond AP: R-tank - Basin A



Summary for Pond BP: R-tank - Basin B

Inflow Area = 2.909 ac, 57.33% Impervious, Inflow Depth = 2.94" for 25-YR event
Inflow = 2.07 cfs @ 7.92 hrs, Volume= 0.712 af
Outflow = 0.53 cfs @ 9.81 hrs, Volume= 0.706 af, Atten= 75%, Lag= 113.3 min
Primary = 0.53 cfs @ 9.81 hrs, Volume= 0.706 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.14' @ 9.81 hrs Surf.Area= 0.061 ac Storage= 0.296 af

Plug-Flow detention time= 1,033.1 min calculated for 0.706 af (99% of inflow)
Center-of-Mass det. time= 1,026.4 min (1,727.4 - 700.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.087 af	**13.19'W x 201.05'L x 8.53'H Field A** 0.519 af Overall - 0.303 af Embedded = 0.217 af x 40.0% Voids
#2A	100.00'	0.288 af	**Ferguson R-Tank SD 10** x 588 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 588 Chambers in 7 Rows
		0.374 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.2" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.53 cfs @ 9.81 hrs HW=106.14' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.53 cfs of 15.59 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.09 cfs @ 11.88 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.43 cfs @ 1.33 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond BP: R-tank - Basin B - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

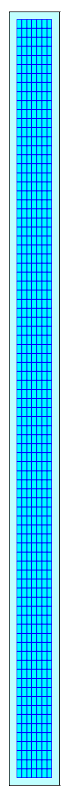
84 Chambers/Row x 2.35' Long = 197.05' Row Length +24.0" End Stone x 2 = 201.05' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

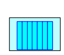
588 Chambers x 21.3 cf = 12,524.9 cf Chamber Storage
588 Chambers x 22.4 cf = 13,184.1 cf Displacement

22,622.9 cf Field - 13,184.1 cf Chambers = 9,438.8 cf Stone x 40.0% Voids = 3,775.5 cf Stone Storage

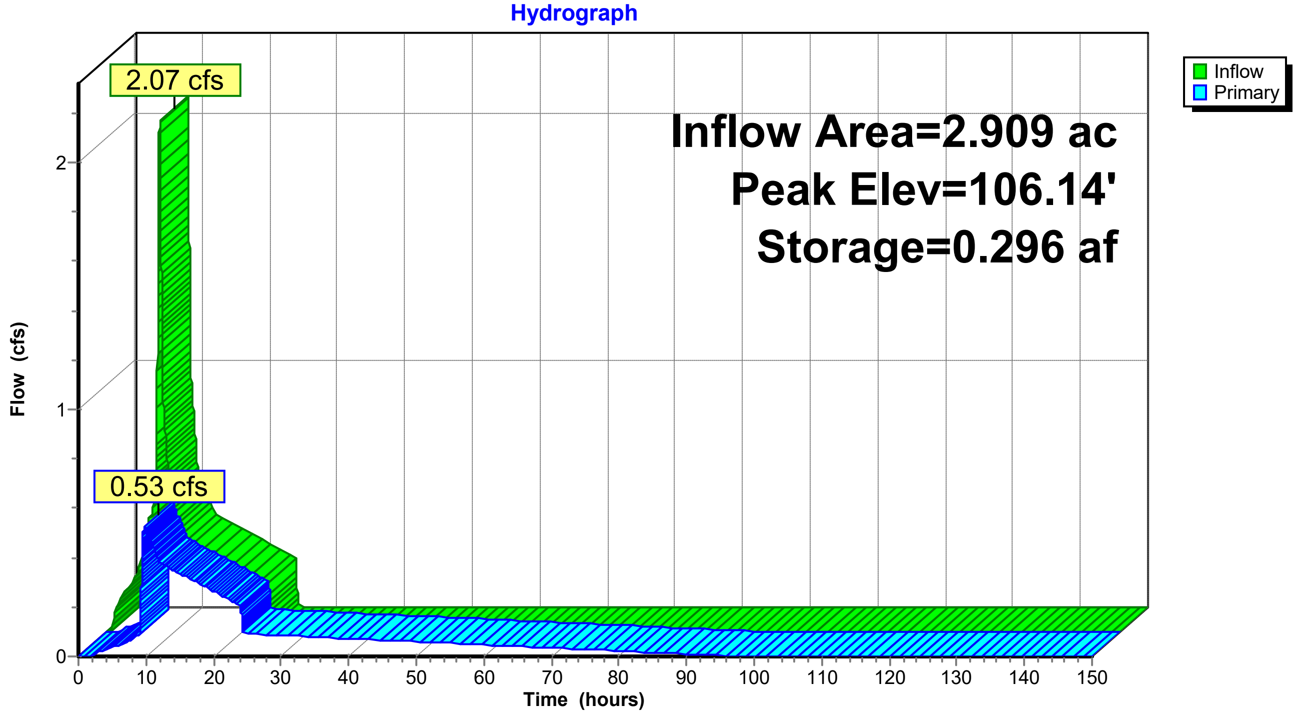
Chamber Storage + Stone Storage = 16,300.4 cf = 0.374 af
Overall Storage Efficiency = 72.1%
Overall System Size = 201.05' x 13.19' x 8.53'

588 Chambers
837.9 cy Field
349.6 cy Stone





Pond BP: R-tank - Basin B



Summary for Pond CP: R-tank - Basin C

Inflow Area = 1.282 ac, 80.45% Impervious, Inflow Depth = 3.33" for 25-YR event
Inflow = 1.05 cfs @ 7.91 hrs, Volume= 0.356 af
Outflow = 0.25 cfs @ 9.85 hrs, Volume= 0.352 af, Atten= 76%, Lag= 116.6 min
Primary = 0.25 cfs @ 9.85 hrs, Volume= 0.352 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.09' @ 9.85 hrs Surf.Area= 0.034 ac Storage= 0.162 af

Plug-Flow detention time= 1,298.7 min calculated for 0.352 af (99% of inflow)
Center-of-Mass det. time= 1,291.1 min (1,968.3 - 677.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.049 af	**13.19'W x 111.91'L x 8.53'H Field A** 0.289 af Overall - 0.166 af Embedded = 0.123 af x 40.0% Voids
#2A	100.00'	0.157 af	**Ferguson R-Tank SD 10** x 322 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 322 Chambers in 7 Rows
		0.207 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.8" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.25 cfs @ 9.85 hrs HW=106.09' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.25 cfs of 15.53 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.04 cfs @ 11.85 fps)
  ├─**3=Weir** (Weir Controls 0.21 cfs @ 1.15 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond CP: R-tank - Basin C - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

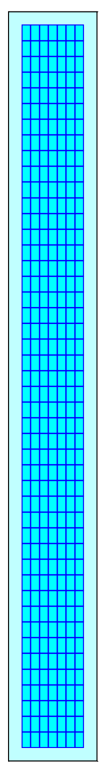
46 Chambers/Row x 2.35' Long = 107.91' Row Length +24.0" End Stone x 2 = 111.91' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

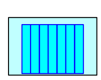
322 Chambers x 21.3 cf = 6,858.9 cf Chamber Storage
322 Chambers x 22.4 cf = 7,219.9 cf Displacement

12,592.3 cf Field - 7,219.9 cf Chambers = 5,372.5 cf Stone x 40.0% Voids = 2,149.0 cf Stone Storage

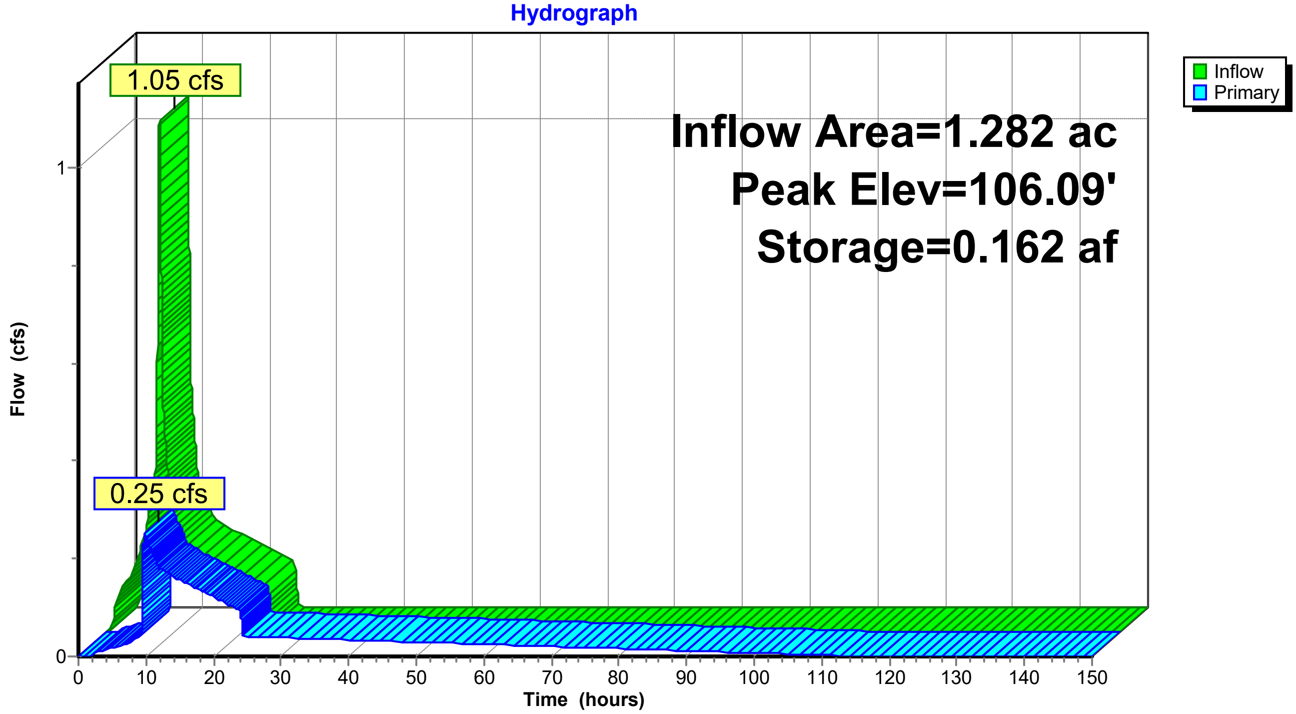
Chamber Storage + Stone Storage = 9,007.9 cf = 0.207 af
Overall Storage Efficiency = 71.5%
Overall System Size = 111.91' x 13.19' x 8.53'

322 Chambers
466.4 cy Field
199.0 cy Stone





Pond CP: R-tank - Basin C



Summary for Pond DP: R-tank - Basin D

Inflow Area = 2.183 ac, 76.16% Impervious, Inflow Depth = 3.26" for 25-YR event
Inflow = 1.74 cfs @ 7.91 hrs, Volume= 0.593 af
Outflow = 0.40 cfs @ 10.11 hrs, Volume= 0.587 af, Atten= 77%, Lag= 132.2 min
Primary = 0.40 cfs @ 10.11 hrs, Volume= 0.587 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.11' @ 10.11 hrs Surf.Area= 0.057 ac Storage= 0.277 af

Plug-Flow detention time= 1,404.5 min calculated for 0.587 af (99% of inflow)
Center-of-Mass det. time= 1,396.5 min (2,077.7 - 681.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.082 af	**13.19'W x 189.32'L x 8.53'H Field A** 0.489 af Overall - 0.285 af Embedded = 0.204 af x 40.0% Voids
#2A	100.00'	0.270 af	**Ferguson R-Tank SD 10** x 553 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 553 Chambers in 7 Rows
		0.352 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.40 cfs @ 10.11 hrs HW=106.11' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.40 cfs of 15.55 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.06 cfs @ 11.86 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.33 cfs @ 1.21 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond DP: R-tank - Basin D - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

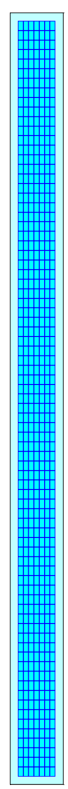
79 Chambers/Row x 2.35' Long = 185.32' Row Length +24.0" End Stone x 2 = 189.32' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

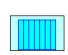
553 Chambers x 21.3 cf = 11,779.4 cf Chamber Storage
553 Chambers x 22.4 cf = 12,399.4 cf Displacement

21,303.1 cf Field - 12,399.4 cf Chambers = 8,903.7 cf Stone x 40.0% Voids = 3,561.5 cf Stone Storage

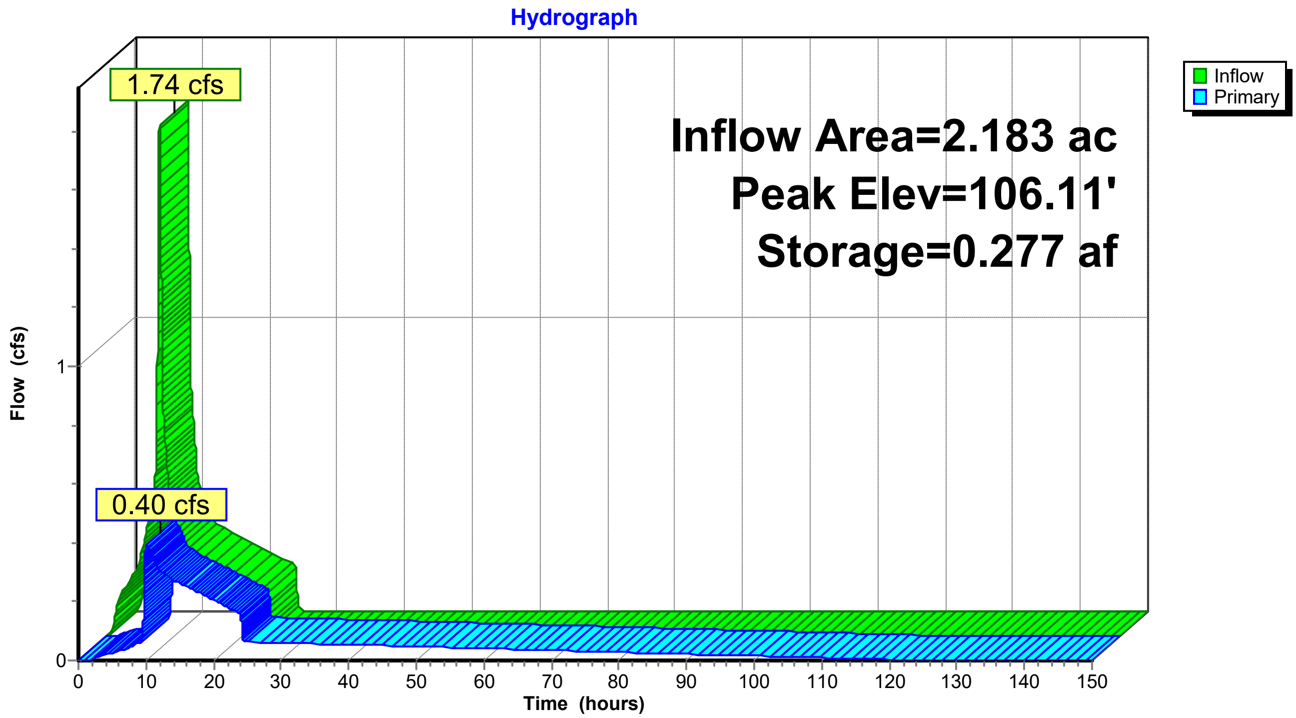
Chamber Storage + Stone Storage = 15,340.9 cf = 0.352 af
Overall Storage Efficiency = 72.0%
Overall System Size = 189.32' x 13.19' x 8.53'

553 Chambers
789.0 cy Field
329.8 cy Stone





Pond DP: R-tank - Basin D



Summary for Pond EP: R-tank - Basin E

Inflow Area = 1.629 ac, 74.48% Impervious, Inflow Depth = 3.23" for 25-YR event
Inflow = 1.29 cfs @ 7.91 hrs, Volume= 0.439 af
Outflow = 0.26 cfs @ 10.99 hrs, Volume= 0.386 af, Atten= 80%, Lag= 185.0 min
Primary = 0.26 cfs @ 10.99 hrs, Volume= 0.386 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.08' @ 10.99 hrs Surf.Area= 0.048 ac Storage= 0.231 af

Plug-Flow detention time= 2,090.7 min calculated for 0.386 af (88% of inflow)
Center-of-Mass det. time= 2,007.3 min (2,690.0 - 682.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.069 af	**13.19'W x 158.82'L x 8.53'H Field A** 0.410 af Overall - 0.238 af Embedded = 0.172 af x 40.0% Voids
#2A	100.00'	0.226 af	**Ferguson R-Tank SD 10** x 462 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 462 Chambers in 7 Rows
		0.295 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.6" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.26 cfs @ 10.99 hrs HW=106.08' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.26 cfs of 15.51 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.02 cfs @ 11.85 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.24 cfs @ 1.09 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond EP: R-tank - Basin E - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

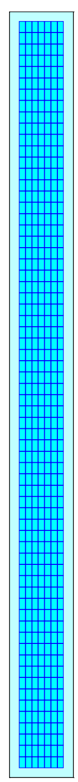
66 Chambers/Row x 2.35' Long = 154.82' Row Length +24.0" End Stone x 2 = 158.82' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

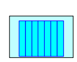
462 Chambers x 21.3 cf = 9,841.0 cf Chamber Storage
462 Chambers x 22.4 cf = 10,359.0 cf Displacement

17,871.6 cf Field - 10,359.0 cf Chambers = 7,512.6 cf Stone x 40.0% Voids = 3,005.0 cf Stone Storage

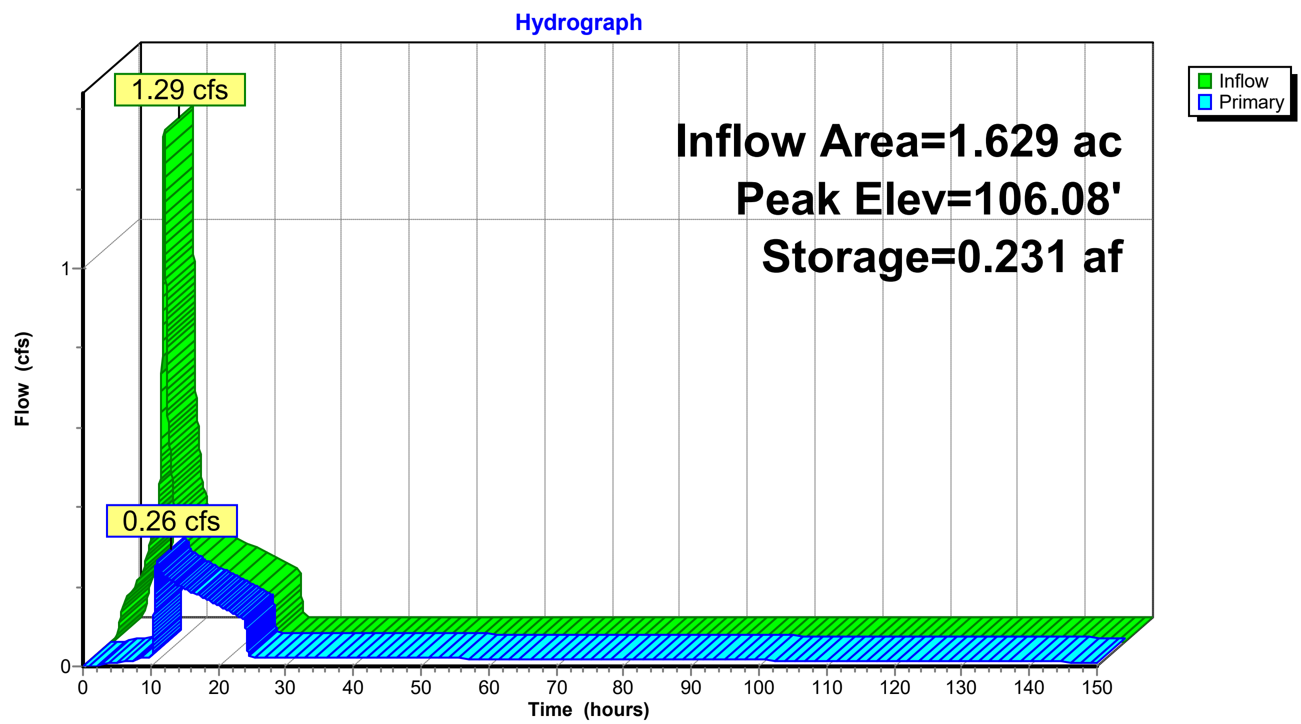
Chamber Storage + Stone Storage = 12,846.1 cf = 0.295 af
Overall Storage Efficiency = 71.9%
Overall System Size = 158.82' x 13.19' x 8.53'

462 Chambers
661.9 cy Field
278.2 cy Stone





Pond EP: R-tank - Basin E



Summary for Pond FP: R-tank - Basin F

Inflow Area = 0.998 ac, 82.99% Impervious, Inflow Depth = 3.38" for 25-YR event
Inflow = 0.83 cfs @ 7.90 hrs, Volume= 0.281 af
Outflow = 0.19 cfs @ 10.11 hrs, Volume= 0.278 af, Atten= 78%, Lag= 132.5 min
Primary = 0.19 cfs @ 10.11 hrs, Volume= 0.278 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.07' @ 10.11 hrs Surf.Area= 0.028 ac Storage= 0.134 af

Plug-Flow detention time= 1,431.6 min calculated for 0.278 af (99% of inflow)
Center-of-Mass det. time= 1,423.9 min (2,098.9 - 674.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.041 af	**13.19'W x 93.14'L x 8.53'H Field A** 0.241 af Overall - 0.137 af Embedded = 0.104 af x 40.0% Voids
#2A	100.00'	0.130 af	**Ferguson R-Tank SD 10** x 266 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 266 Chambers in 7 Rows
		0.172 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.7" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.19 cfs @ 10.11 hrs HW=106.07' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.19 cfs of 15.49 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.03 cfs @ 11.83 fps)
  ├─**3=Weir** (Weir Controls 0.15 cfs @ 1.04 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond FP: R-tank - Basin F - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

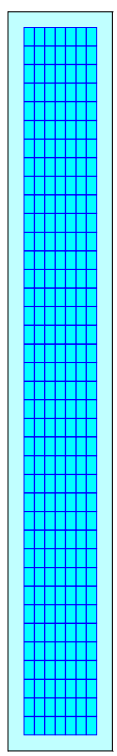
38 Chambers/Row x 2.35' Long = 89.14' Row Length +24.0" End Stone x 2 = 93.14' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

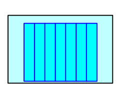
266 Chambers x 21.3 cf = 5,666.0 cf Chamber Storage
266 Chambers x 22.4 cf = 5,964.2 cf Displacement

10,480.7 cf Field - 5,964.2 cf Chambers = 4,516.4 cf Stone x 40.0% Voids = 1,806.6 cf Stone Storage

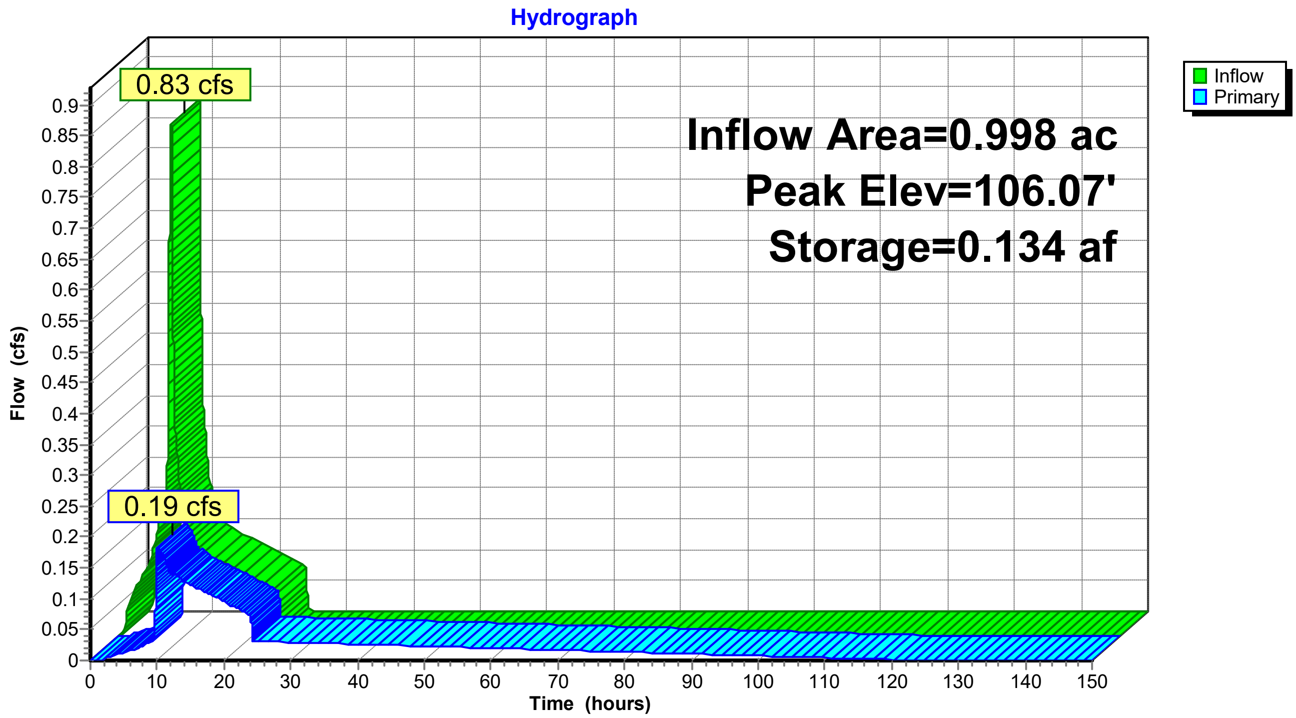
Chamber Storage + Stone Storage = 7,472.6 cf = 0.172 af
Overall Storage Efficiency = 71.3%
Overall System Size = 93.14' x 13.19' x 8.53'

266 Chambers
388.2 cy Field
167.3 cy Stone





Pond FP: R-tank - Basin F



Summary for Pond GP: Planter - Basin G

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 0.445 ac, 92.02% Impervious, Inflow Depth = 3.53" for 25-YR event
Inflow = 0.39 cfs @ 7.90 hrs, Volume= 0.131 af
Outflow = 0.08 cfs @ 10.28 hrs, Volume= 0.129 af, Atten= 79%, Lag= 142.6 min
Primary = 0.08 cfs @ 10.28 hrs, Volume= 0.129 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.88' @ 10.28 hrs Surf.Area= 2,320 sf Storage= 2,873 cf

Plug-Flow detention time= 1,894.5 min calculated for 0.129 af (99% of inflow)
Center-of-Mass det. time= 1,884.8 min (2,552.1 - 667.3)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	2,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,856 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,640 cf Overall x 40.0% Voids
		4,176 cf	Total Available Storage

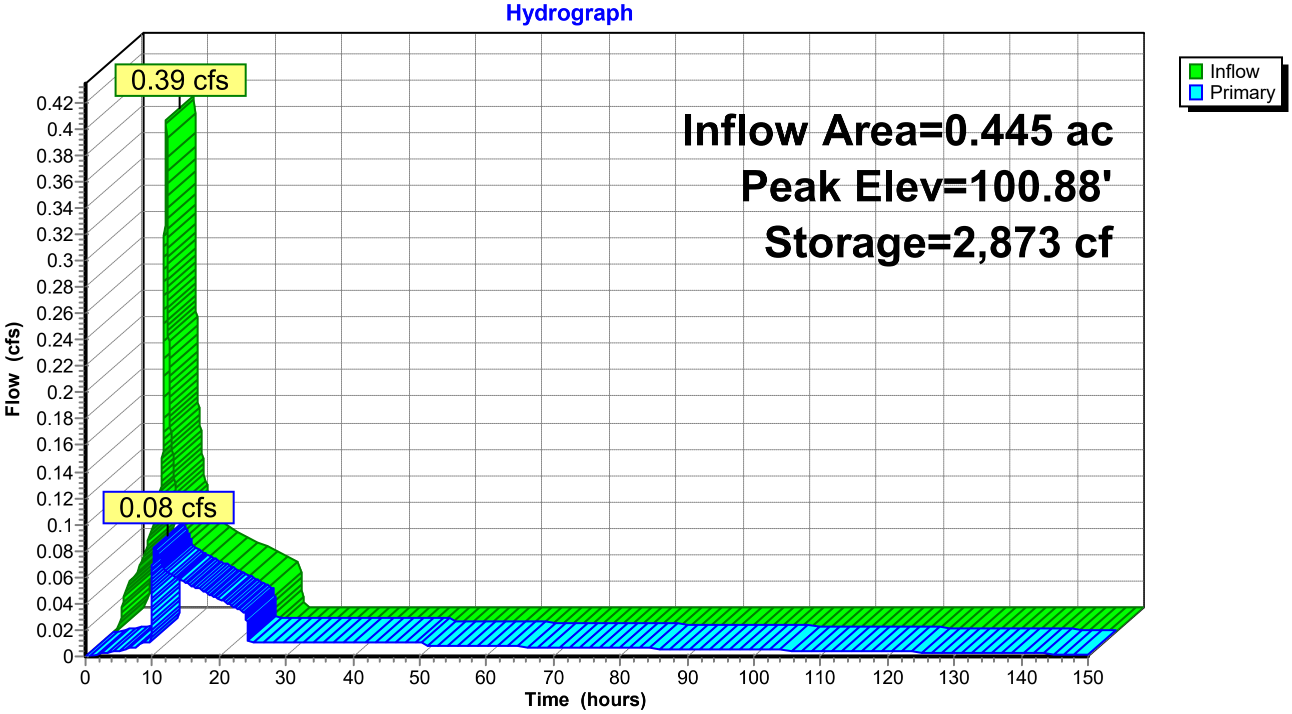
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	1,160	0	0
102.00	1,160	2,320	2,320

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	1,160	0	0
98.25	1,160	4,640	4,640

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.84'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.08 cfs @ 10.28 hrs HW=100.88' TW=0.00' (Dynamic Tailwater)
1=Culvert (Passes 0.08 cfs of 16.28 cfs potential flow)
3=Orifice A (Orifice Controls 0.01 cfs @ 12.38 fps)
2=Beehive OF (Controls 0.00 cfs)
4=Underdrain (Passes 0.01 cfs of 2.39 cfs potential flow)
5=Orifice B (Weir Controls 0.07 cfs @ 0.62 fps)

Pond GP: Planter - Basin G



Summary for Pond HP: Planter - Basin H

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 0.339 ac, 86.24% Impervious, Inflow Depth = 3.43" for 25-YR event
Inflow = 0.29 cfs @ 7.90 hrs, Volume= 0.097 af
Outflow = 0.07 cfs @ 9.62 hrs, Volume= 0.097 af, Atten= 75%, Lag= 103.2 min
Primary = 0.07 cfs @ 9.62 hrs, Volume= 0.097 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.99' @ 9.62 hrs Surf.Area= 1,476 sf Storage= 1,913 cf

Plug-Flow detention time= 1,324.2 min calculated for 0.097 af (100% of inflow)
Center-of-Mass det. time= 1,324.0 min (1,996.1 - 672.1)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,476 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,181 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 2,952 cf Overall x 40.0% Voids
		2,657 cf	Total Available Storage

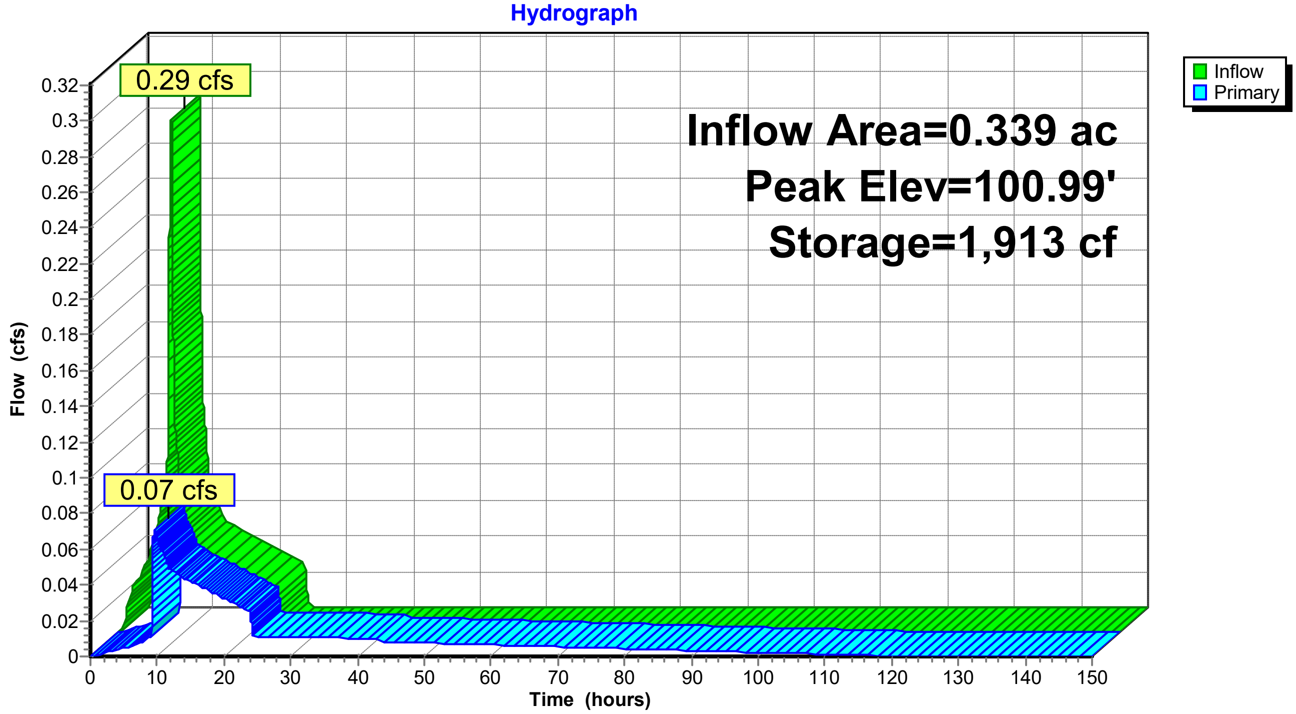
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	738	0	0
102.00	738	1,476	1,476

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	738	0	0
98.25	738	2,952	2,952

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.96'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.07 cfs @ 9.62 hrs HW=100.99' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.07 cfs of 16.44 cfs potential flow)
  ├─**3=Orifice A** (Orifice Controls 0.01 cfs @ 12.49 fps)
  │ ├─**2=Beehive OF** (Controls 0.00 cfs)
  │ └─**4=Underdrain** (Passes 0.01 cfs of 2.41 cfs potential flow)
  └─**5=Orifice B** (Weir Controls 0.06 cfs @ 0.59 fps)

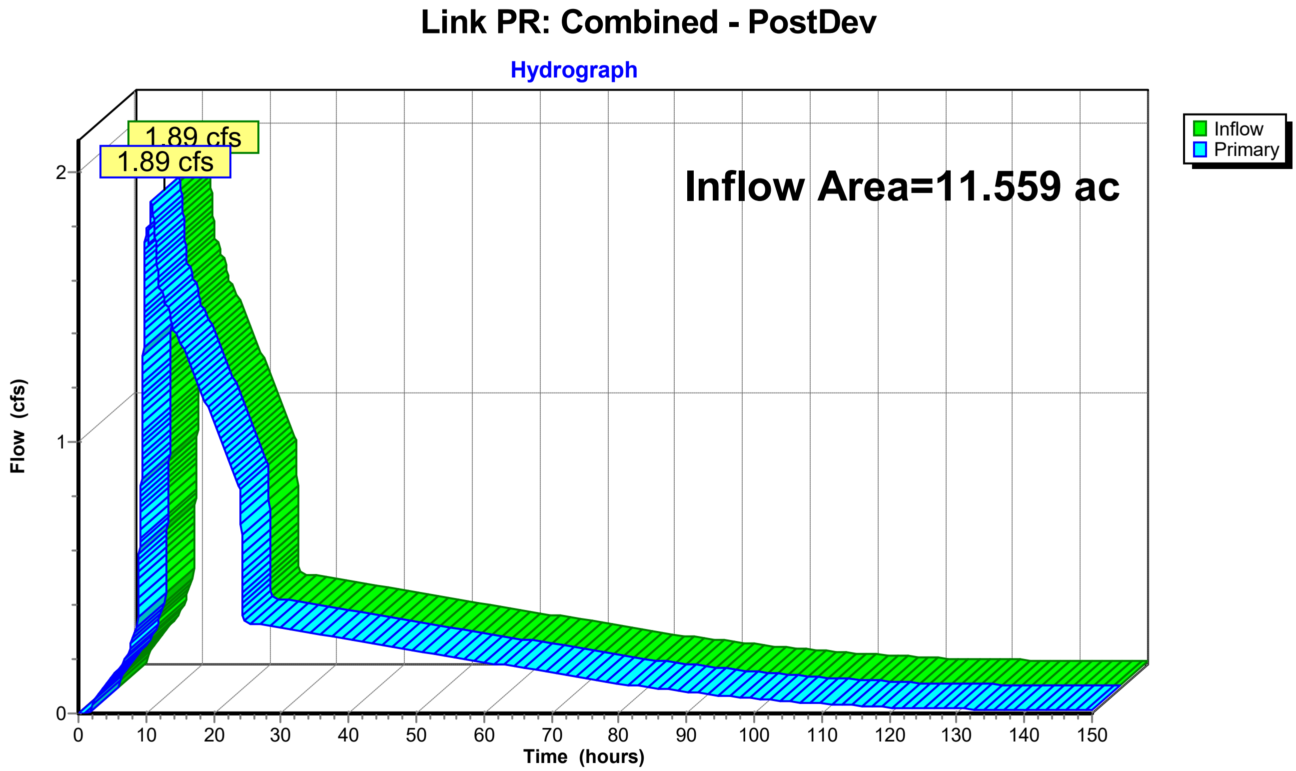
Pond HP: Planter - Basin H



Summary for Link PR: Combined - PostDev

Inflow Area = 11.559 ac, 69.42% Impervious, Inflow Depth > 3.06" for 25-YR event
Inflow = 1.89 cfs @ 10.79 hrs, Volume= 2.951 af
Primary = 1.89 cfs @ 10.79 hrs, Volume= 2.951 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs



Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment A: Post-Dev - Basin A Runoff Area=77,258 sf 51.80% Impervious Runoff Depth=3.62"
Tc=6.0 min CN=80/98 Runoff=1.56 cfs 0.535 af

Subcatchment B: Post-Dev - Basin B Runoff Area=126,737 sf 57.33% Impervious Runoff Depth=3.72"
Tc=6.0 min CN=80/98 Runoff=2.64 cfs 0.902 af

Subcatchment C: Post-Dev - Basin C Runoff Area=55,842 sf 80.45% Impervious Runoff Depth=4.14"
Tc=6.0 min CN=80/98 Runoff=1.30 cfs 0.443 af

Subcatchment D: Post-Dev - Basin D Runoff Area=95,094 sf 76.16% Impervious Runoff Depth=4.07"
Tc=6.0 min CN=80/98 Runoff=2.17 cfs 0.740 af

Subcatchment E: Post-Dev - Basin E Runoff Area=70,966 sf 74.48% Impervious Runoff Depth=4.03"
Tc=6.0 min CN=80/98 Runoff=1.61 cfs 0.548 af

Subcatchment EX: Pre-Dev Runoff Area=508,228 sf 0.00% Impervious Runoff Depth=1.85"
Tc=10.0 min CN=70/0 Runoff=4.21 cfs 1.795 af

Subcatchment F: Post-Dev - Basin F Runoff Area=43,479 sf 82.99% Impervious Runoff Depth=4.19"
Tc=6.0 min CN=80/98 Runoff=1.03 cfs 0.349 af

Subcatchment G: Post-Dev - Basin G Runoff Area=19,378 sf 92.02% Impervious Runoff Depth=4.36"
Tc=6.0 min CN=80/98 Runoff=0.48 cfs 0.162 af

Subcatchment H: Post-Dev - Basin H Runoff Area=14,773 sf 86.24% Impervious Runoff Depth=4.25"
Tc=6.0 min CN=80/98 Runoff=0.35 cfs 0.120 af

Pond AP: R-tank - Basin A Peak Elev=106.29' Storage=0.160 af Inflow=1.56 cfs 0.535 af
Outflow=0.93 cfs 0.532 af

Pond BP: R-tank - Basin B Peak Elev=106.28' Storage=0.302 af Inflow=2.64 cfs 0.902 af
Outflow=1.18 cfs 0.896 af

Pond CP: R-tank - Basin C Peak Elev=106.20' Storage=0.165 af Inflow=1.30 cfs 0.443 af
Outflow=0.56 cfs 0.439 af

Pond DP: R-tank - Basin D Peak Elev=106.21' Storage=0.282 af Inflow=2.17 cfs 0.740 af
Outflow=0.84 cfs 0.733 af

Pond EP: R-tank - Basin E Peak Elev=106.15' Storage=0.234 af Inflow=1.61 cfs 0.548 af
Outflow=0.52 cfs 0.495 af

Pond FP: R-tank - Basin F Peak Elev=106.15' Storage=0.136 af Inflow=1.03 cfs 0.349 af
Outflow=0.40 cfs 0.346 af

Pond GP: Planter - Basin G Peak Elev=100.90' Storage=2,905 cf Inflow=0.48 cfs 0.162 af
Outflow=0.18 cfs 0.160 af

Pond HP: Planter - Basin H Peak Elev=101.02' Storage=1,936 cf Inflow=0.35 cfs 0.120 af
Outflow=0.18 cfs 0.120 af

Link PR: Combined - PostDev Inflow=4.04 cfs 3.721 af
Primary=4.04 cfs 3.721 af

Total Runoff Area = 23.227 ac Runoff Volume = 5.592 af Average Runoff Depth = 2.89"
65.45% Pervious = 15.202 ac 34.55% Impervious = 8.024 ac

Summary for Subcatchment A: Post-Dev - Basin A

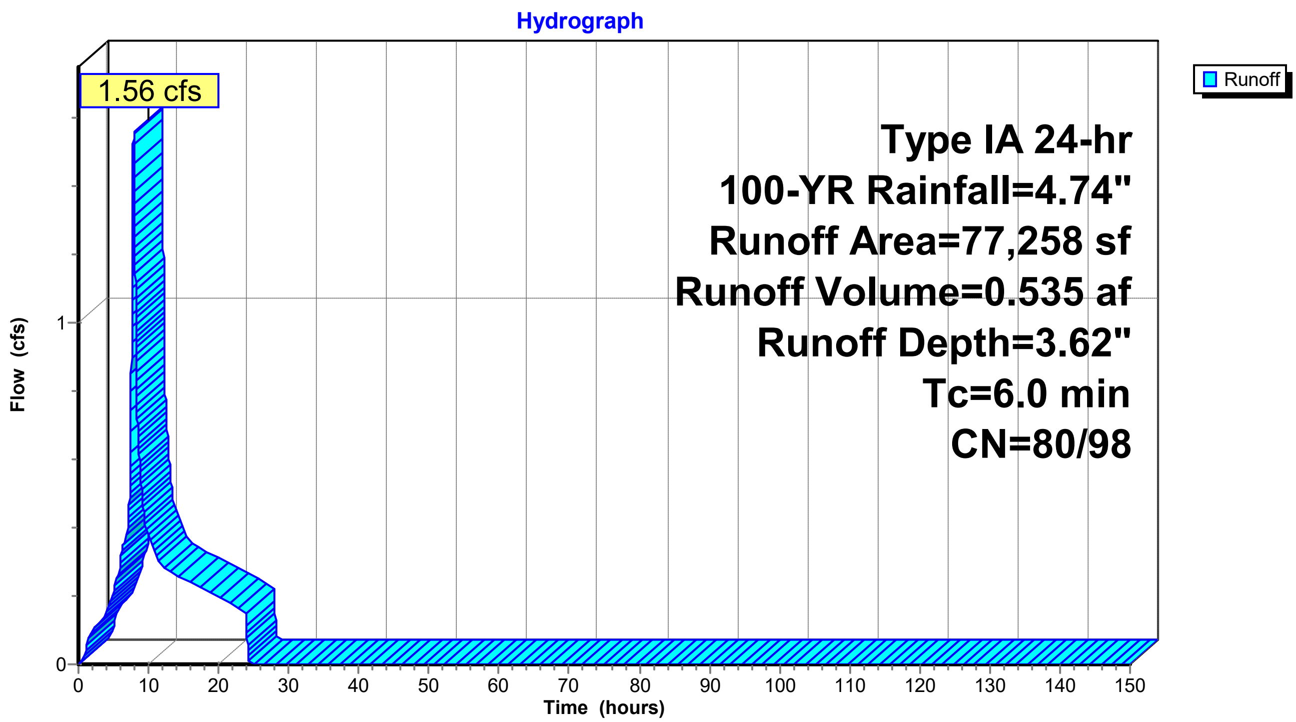
Runoff = 1.56 cfs @ 7.92 hrs, Volume= 0.535 af, Depth= 3.62"
Routed to Pond AP : R-tank - Basin A

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	40,023	98	
*	37,235	80	
	77,258	89	Weighted Average
	37,235	80	48.20% Pervious Area
	40,023	98	51.80% Impervious Area

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

Subcatchment A: Post-Dev - Basin A



Summary for Subcatchment B: Post-Dev - Basin B

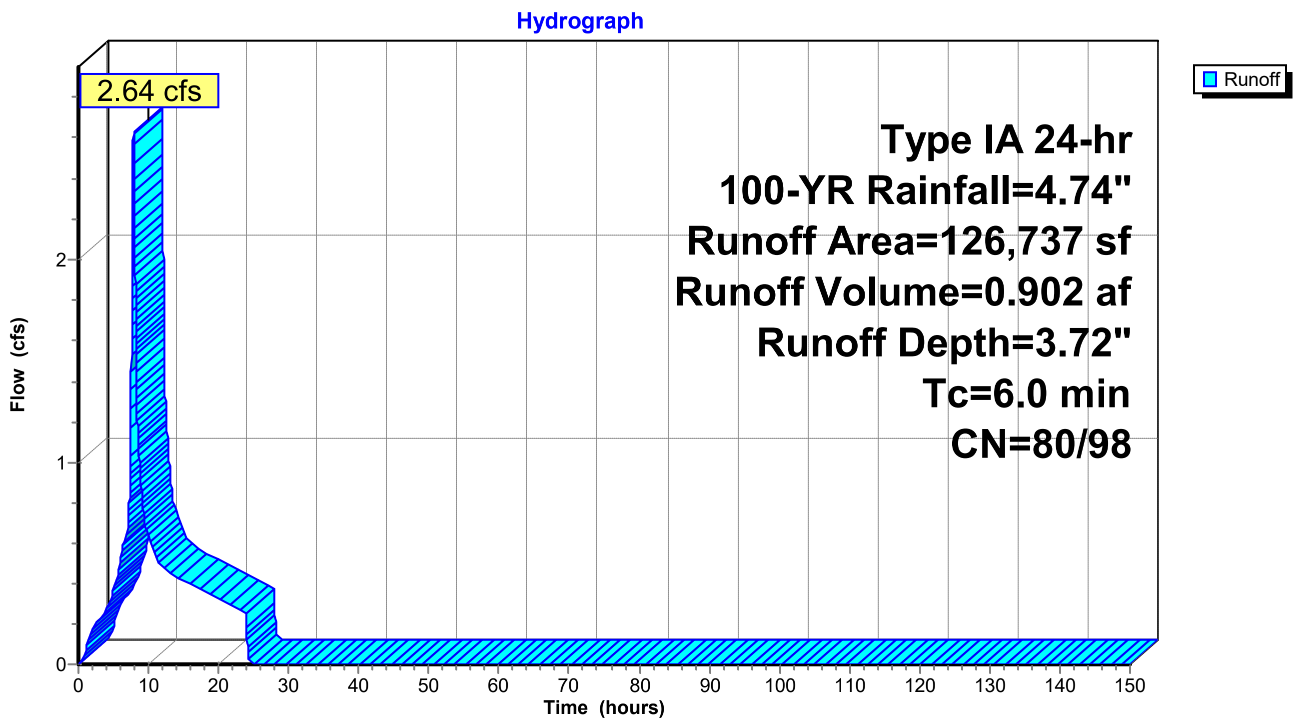
Runoff = 2.64 cfs @ 7.92 hrs, Volume= 0.902 af, Depth= 3.72"
Routed to Pond BP : R-tank - Basin B

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	72,652	98	
*	54,085	80	
	126,737	90	Weighted Average
	54,085	80	42.67% Pervious Area
	72,652	98	57.33% Impervious Area

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

Subcatchment B: Post-Dev - Basin B



Summary for Subcatchment C: Post-Dev - Basin C

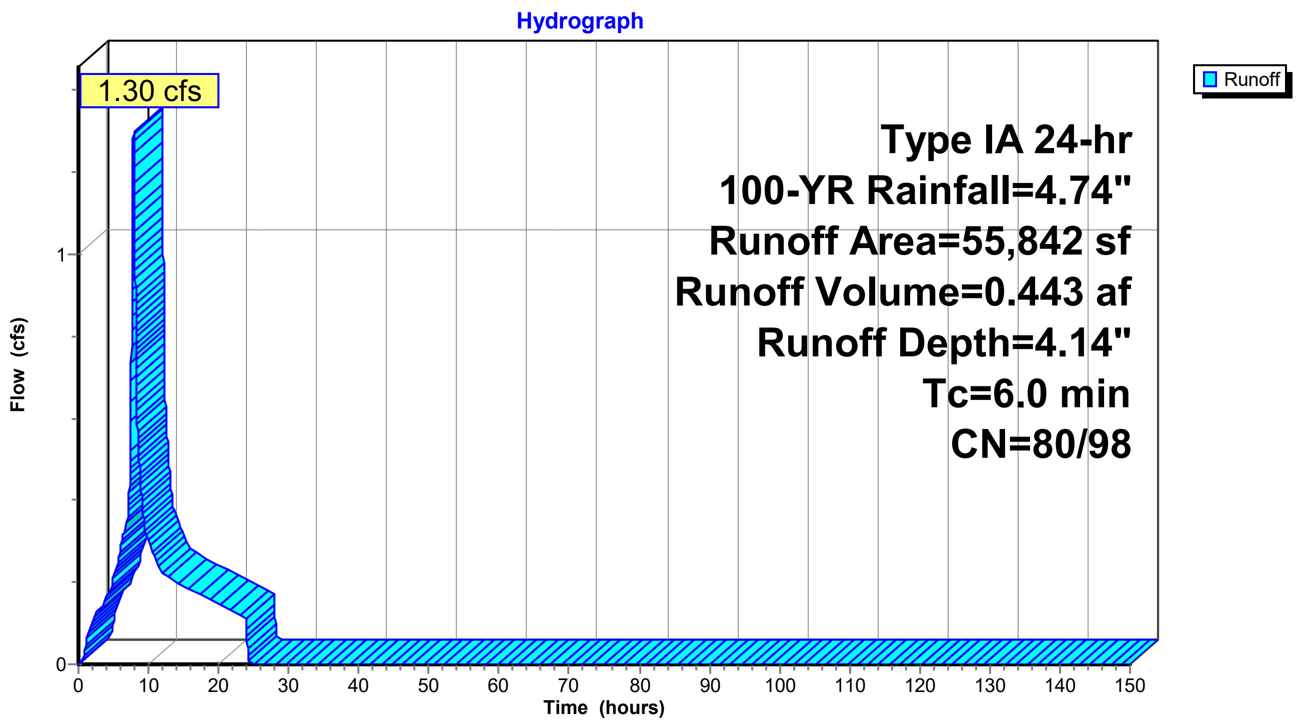
Runoff = 1.30 cfs @ 7.90 hrs, Volume= 0.443 af, Depth= 4.14"
Routed to Pond CP : R-tank - Basin C

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	44,926	98	
*	10,916	80	
	55,842	94	Weighted Average
	10,916	80	19.55% Pervious Area
	44,926	98	80.45% Impervious Area

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

Subcatchment C: Post-Dev - Basin C



Summary for Subcatchment D: Post-Dev - Basin D

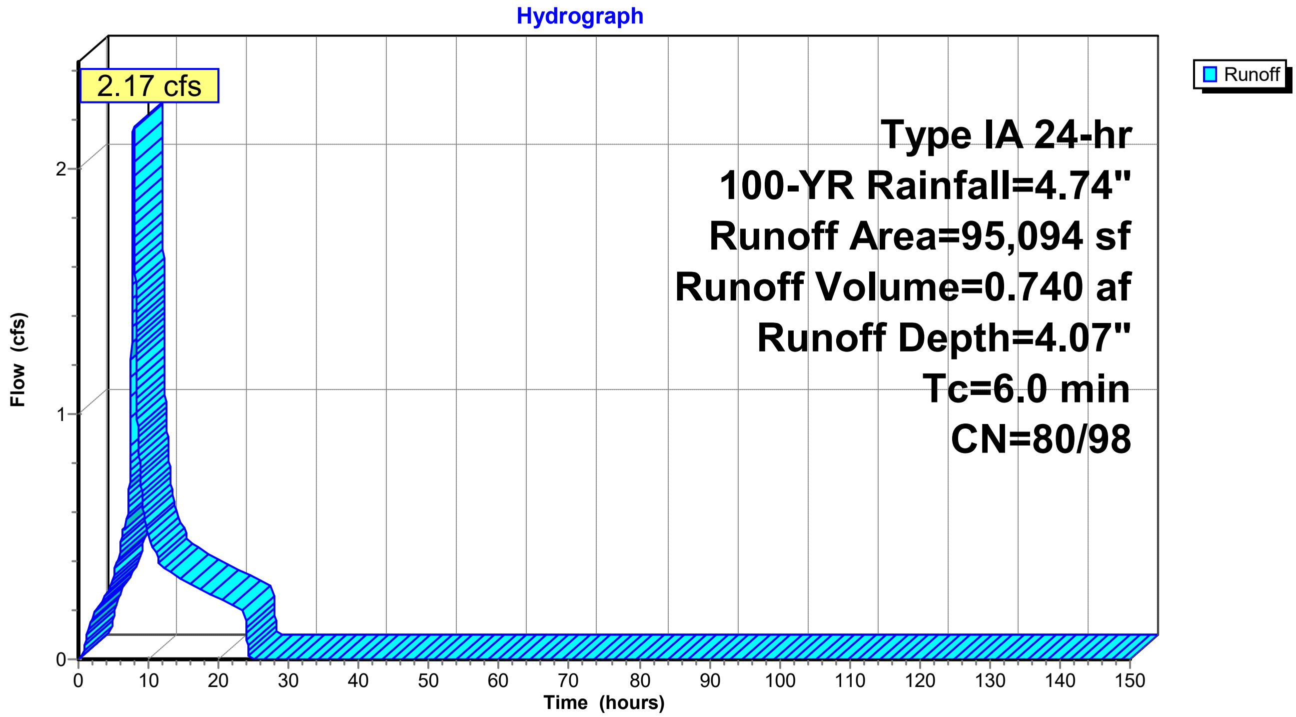
Runoff = 2.17 cfs @ 7.91 hrs, Volume= 0.740 af, Depth= 4.07"
Routed to Pond DP : R-tank - Basin D

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	72,428	98	
*	22,666	80	
	95,094	94	Weighted Average
	22,666	80	23.84% Pervious Area
	72,428	98	76.16% Impervious Area

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

Subcatchment D: Post-Dev - Basin D



Summary for Subcatchment E: Post-Dev - Basin E

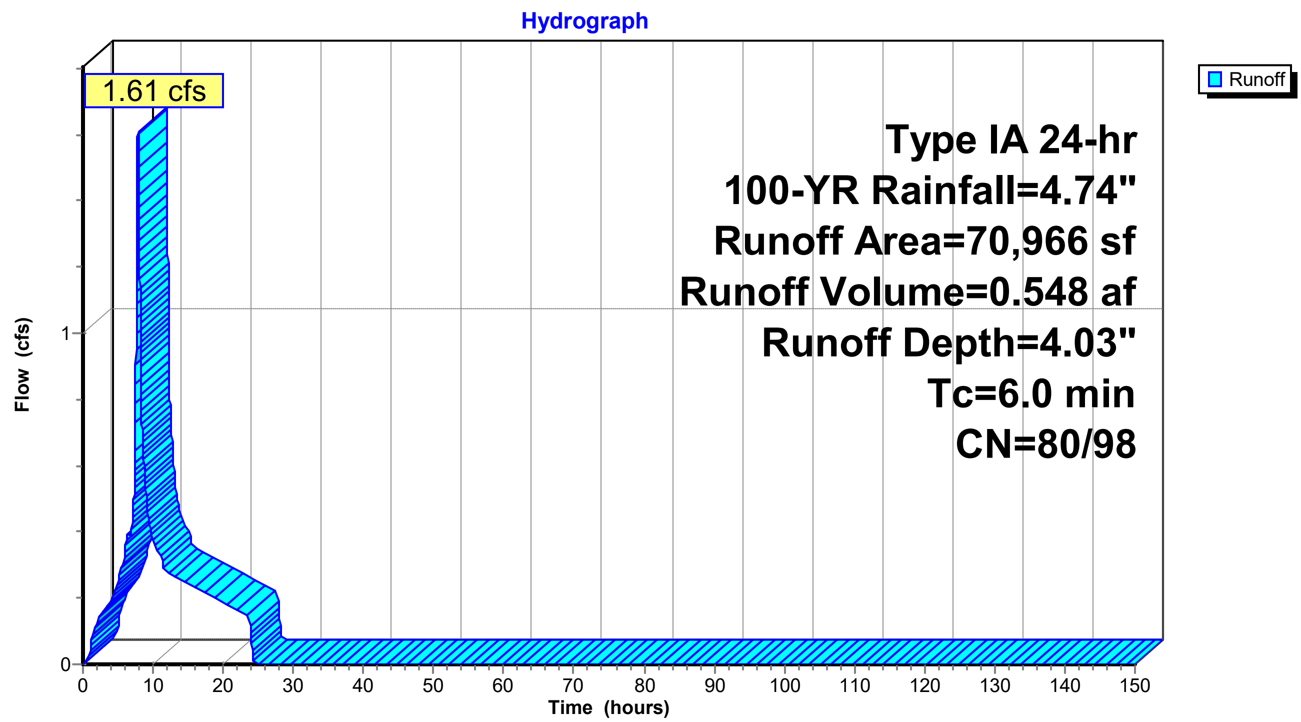
Runoff = 1.61 cfs @ 7.91 hrs, Volume= 0.548 af, Depth= 4.03"
Routed to Pond EP : R-tank - Basin E

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	52,854	98	
*	18,112	80	
	70,966	93	Weighted Average
	18,112	80	25.52% Pervious Area
	52,854	98	74.48% Impervious Area

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

Subcatchment E: Post-Dev - Basin E



Summary for Subcatchment EX: Pre-Dev

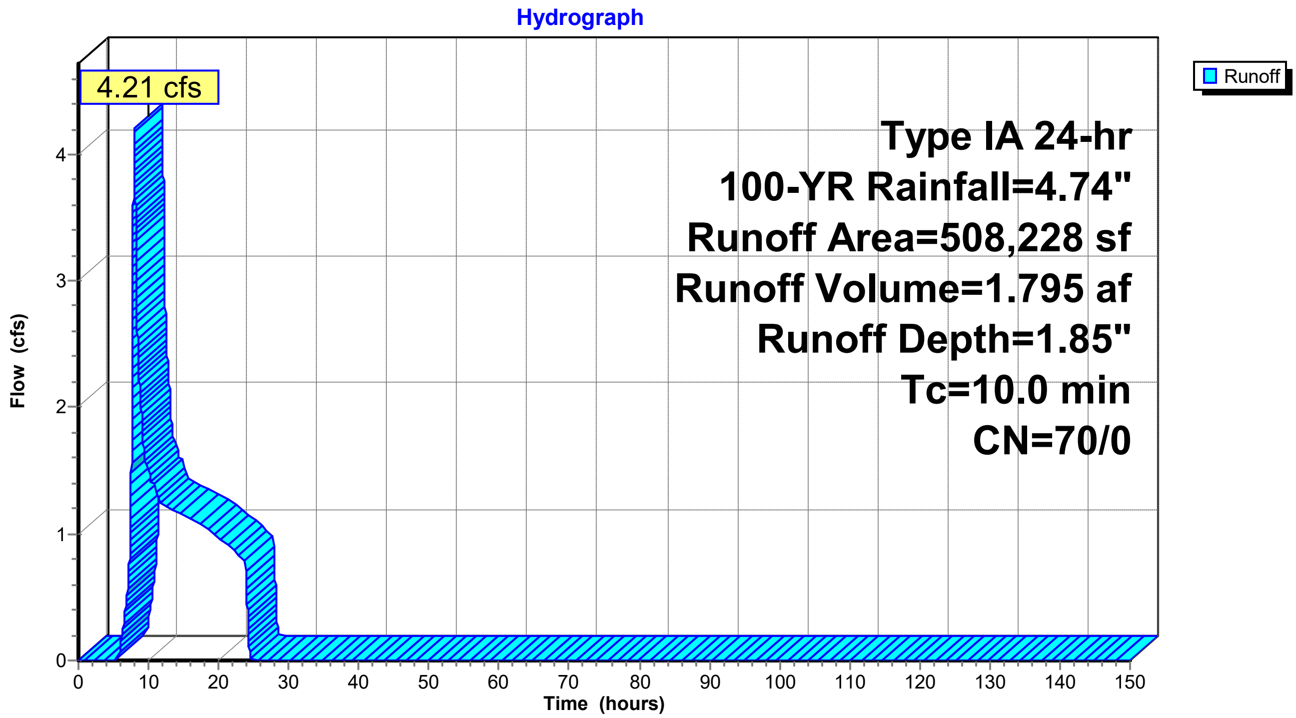
Runoff = 4.21 cfs @ 8.00 hrs, Volume= 1.795 af, Depth= 1.85"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	508,228	70	
	508,228	70	100.00% Pervious Area

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

Subcatchment EX: Pre-Dev



Summary for Subcatchment F: Post-Dev - Basin F

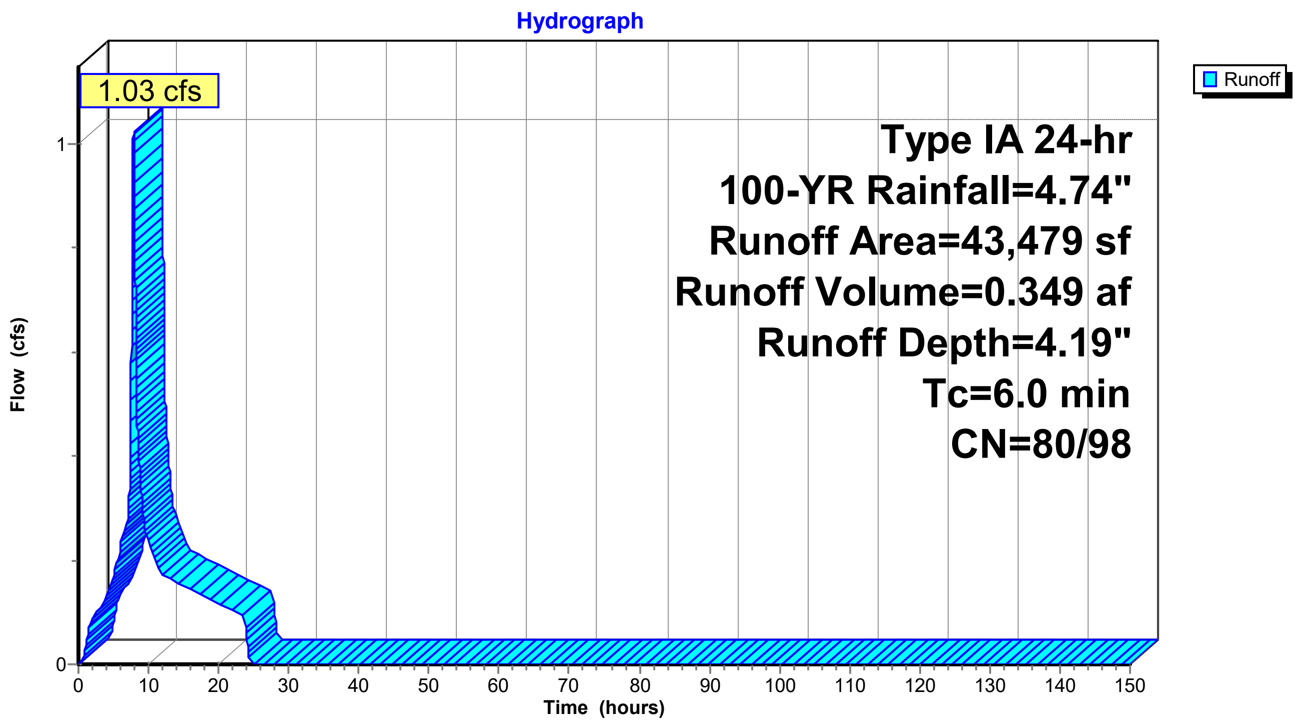
Runoff = 1.03 cfs @ 7.90 hrs, Volume= 0.349 af, Depth= 4.19"
Routed to Pond FP : R-tank - Basin F

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	36,082	98	
*	7,397	80	
	43,479	95	Weighted Average
	7,397	80	17.01% Pervious Area
	36,082	98	82.99% Impervious Area

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

Subcatchment F: Post-Dev - Basin F



Summary for Subcatchment G: Post-Dev - Basin G

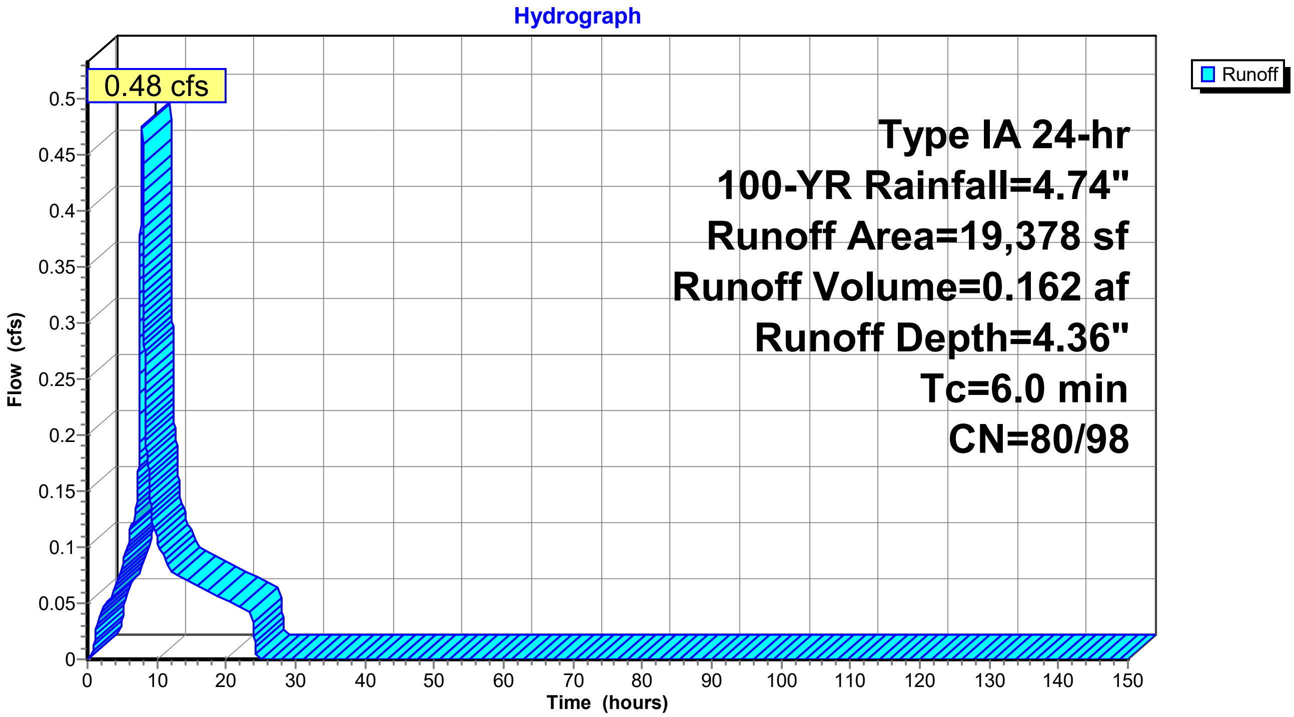
Runoff = 0.48 cfs @ 7.90 hrs, Volume= 0.162 af, Depth= 4.36"
Routed to Pond GP : Planter - Basin G

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	17,831	98	
*	1,547	80	
	19,378	97	Weighted Average
	1,547	80	7.98% Pervious Area
	17,831	98	92.02% Impervious Area

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

Subcatchment G: Post-Dev - Basin G



Summary for Subcatchment H: Post-Dev - Basin H

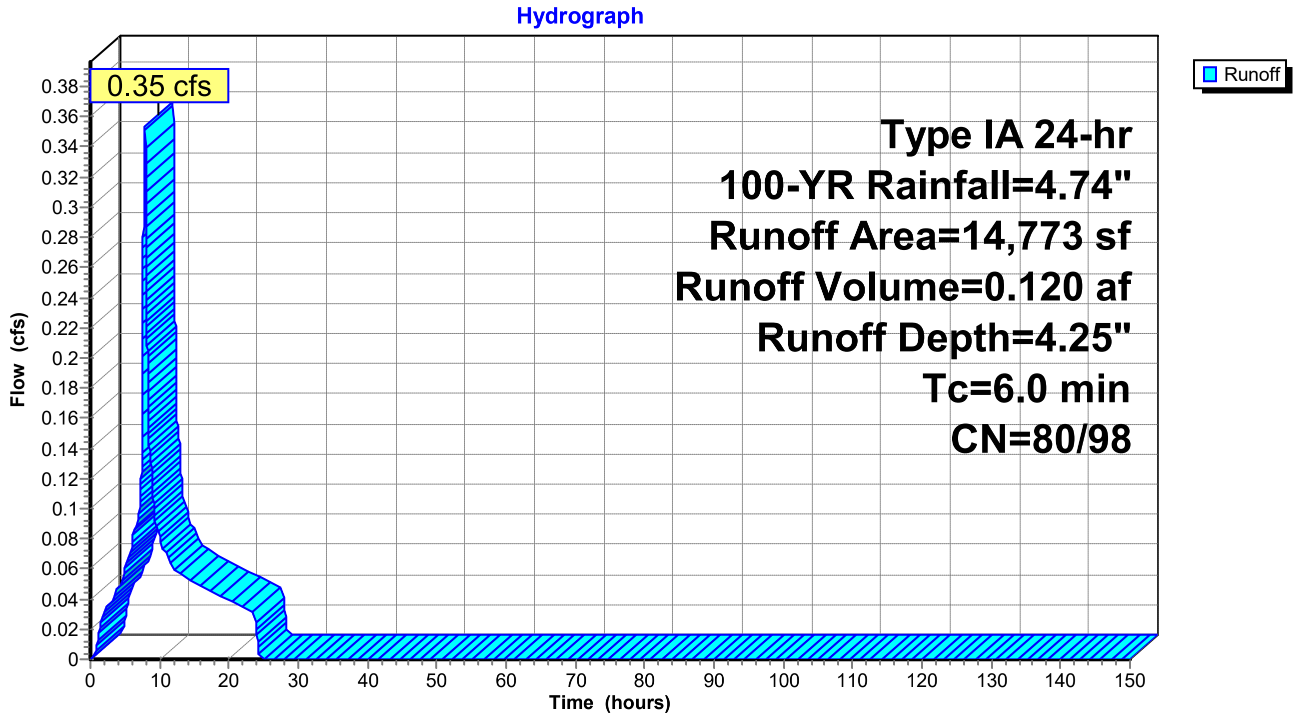
Runoff = 0.35 cfs @ 7.90 hrs, Volume= 0.120 af, Depth= 4.25"
Routed to Pond HP : Planter - Basin H

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100-YR Rainfall=4.74"

	Area (sf)	CN	Description
*	12,740	98	
*	2,033	80	
	14,773	96	Weighted Average
	2,033	80	13.76% Pervious Area
	12,740	98	86.24% Impervious Area

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

Subcatchment H: Post-Dev - Basin H



Summary for Pond AP: R-tank - Basin A

Inflow Area = 1.774 ac, 51.80% Impervious, Inflow Depth = 3.62" for 100-YR event
Inflow = 1.56 cfs @ 7.92 hrs, Volume= 0.535 af
Outflow = 0.93 cfs @ 8.23 hrs, Volume= 0.532 af, Atten= 40%, Lag= 18.3 min
Primary = 0.93 cfs @ 8.23 hrs, Volume= 0.532 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.29' @ 8.23 hrs Surf.Area= 0.032 ac Storage= 0.160 af

Plug-Flow detention time= 636.0 min calculated for 0.531 af (99% of inflow)
Center-of-Mass det. time= 631.8 min (1,333.1 - 701.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.047 af	**13.19'W x 107.22'L x 8.53'H Field A** 0.277 af Overall - 0.159 af Embedded = 0.118 af x 40.0% Voids
#2A	100.00'	0.151 af	**Ferguson R-Tank SD 10** x 308 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 308 Chambers in 7 Rows
		0.198 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.93 cfs @ 8.23 hrs HW=106.29' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.93 cfs of 15.82 cfs potential flow)
 ├─**2=Primary Orifice** (Orifice Controls 0.07 cfs @ 12.04 fps)
 ├─**3=Weir** (Weir Controls 0.87 cfs @ 1.86 fps)
 └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond AP: R-tank - Basin A - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

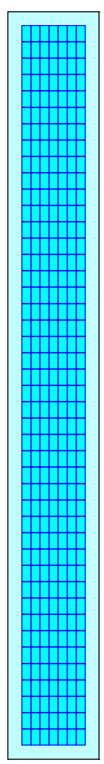
44 Chambers/Row x 2.35' Long = 103.22' Row Length +24.0" End Stone x 2 = 107.22' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

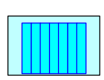
308 Chambers x 21.3 cf = 6,560.7 cf Chamber Storage
308 Chambers x 22.4 cf = 6,906.0 cf Displacement

12,064.4 cf Field - 6,906.0 cf Chambers = 5,158.4 cf Stone x 40.0% Voids = 2,063.4 cf Stone Storage

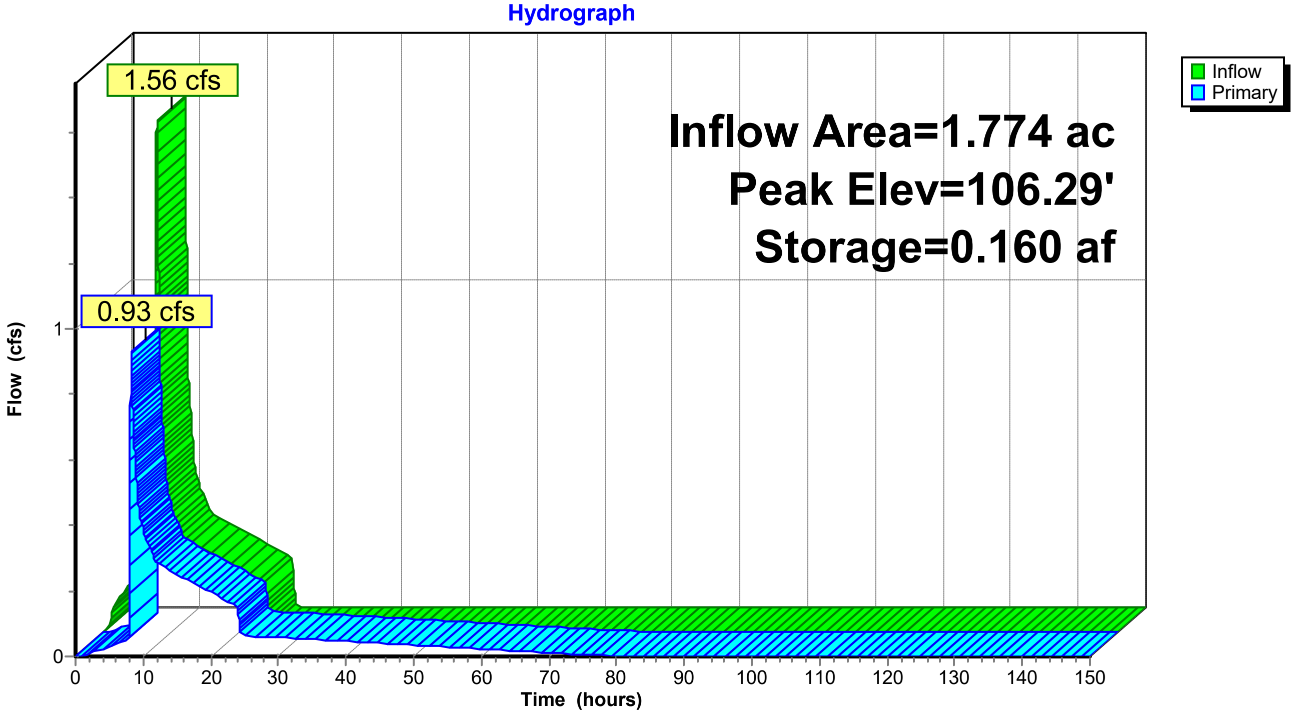
Chamber Storage + Stone Storage = 8,624.1 cf = 0.198 af
Overall Storage Efficiency = 71.5%
Overall System Size = 107.22' x 13.19' x 8.53'

308 Chambers
446.8 cy Field
191.1 cy Stone





Pond AP: R-tank - Basin A



Summary for Pond BP: R-tank - Basin B

Inflow Area = 2.909 ac, 57.33% Impervious, Inflow Depth = 3.72" for 100-YR event
Inflow = 2.64 cfs @ 7.92 hrs, Volume= 0.902 af
Outflow = 1.18 cfs @ 8.42 hrs, Volume= 0.896 af, Atten= 55%, Lag= 29.8 min
Primary = 1.18 cfs @ 8.42 hrs, Volume= 0.896 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.28' @ 8.42 hrs Surf.Area= 0.061 ac Storage= 0.302 af

Plug-Flow detention time= 828.2 min calculated for 0.896 af (99% of inflow)
Center-of-Mass det. time= 822.9 min (1,518.1 - 695.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.087 af	**13.19'W x 201.05'L x 8.53'H Field A** 0.519 af Overall - 0.303 af Embedded = 0.217 af x 40.0% Voids
#2A	100.00'	0.288 af	**Ferguson R-Tank SD 10** x 588 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 588 Chambers in 7 Rows
		0.374 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.2" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=1.18 cfs @ 8.42 hrs HW=106.28' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.18 cfs of 15.79 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.09 cfs @ 12.02 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 1.08 cfs @ 1.81 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond BP: R-tank - Basin B - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

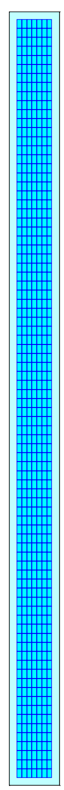
84 Chambers/Row x 2.35' Long = 197.05' Row Length +24.0" End Stone x 2 = 201.05' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

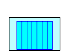
588 Chambers x 21.3 cf = 12,524.9 cf Chamber Storage
588 Chambers x 22.4 cf = 13,184.1 cf Displacement

22,622.9 cf Field - 13,184.1 cf Chambers = 9,438.8 cf Stone x 40.0% Voids = 3,775.5 cf Stone Storage

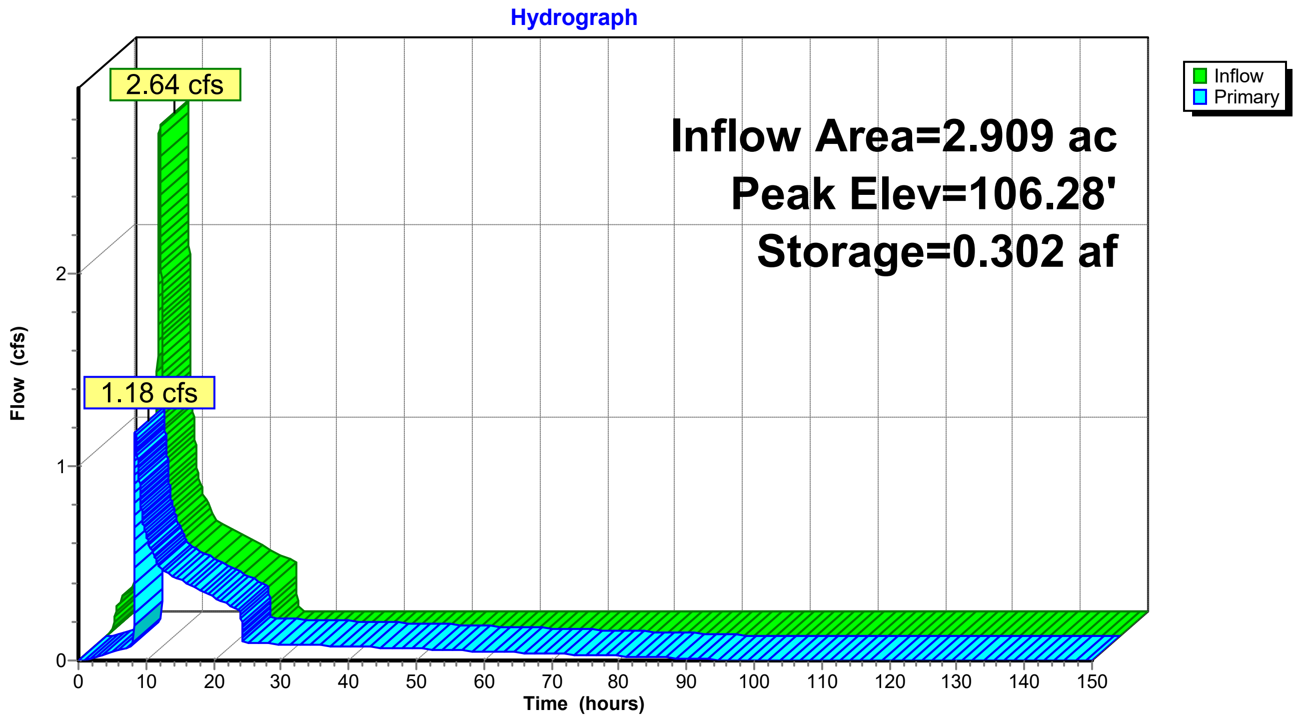
Chamber Storage + Stone Storage = 16,300.4 cf = 0.374 af
Overall Storage Efficiency = 72.1%
Overall System Size = 201.05' x 13.19' x 8.53'

588 Chambers
837.9 cy Field
349.6 cy Stone





Pond BP: R-tank - Basin B



Summary for Pond CP: R-tank - Basin C

Inflow Area = 1.282 ac, 80.45% Impervious, Inflow Depth = 4.14" for 100-YR event
Inflow = 1.30 cfs @ 7.90 hrs, Volume= 0.443 af
Outflow = 0.56 cfs @ 8.43 hrs, Volume= 0.439 af, Atten= 57%, Lag= 31.6 min
Primary = 0.56 cfs @ 8.43 hrs, Volume= 0.439 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.20' @ 8.43 hrs Surf.Area= 0.034 ac Storage= 0.165 af

Plug-Flow detention time= 1,057.1 min calculated for 0.439 af (99% of inflow)
Center-of-Mass det. time= 1,051.0 min (1,723.6 - 672.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.049 af	**13.19'W x 111.91'L x 8.53'H Field A** 0.289 af Overall - 0.166 af Embedded = 0.123 af x 40.0% Voids
#2A	100.00'	0.157 af	**Ferguson R-Tank SD 10** x 322 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 322 Chambers in 7 Rows
		0.207 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.8" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.56 cfs @ 8.43 hrs HW=106.20' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.56 cfs of 15.68 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.04 cfs @ 11.95 fps)
  ├─**3=Weir** (Weir Controls 0.52 cfs @ 1.56 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond CP: R-tank - Basin C - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

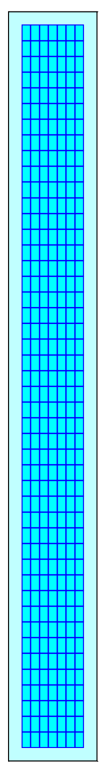
46 Chambers/Row x 2.35' Long = 107.91' Row Length +24.0" End Stone x 2 = 111.91' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

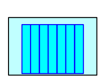
322 Chambers x 21.3 cf = 6,858.9 cf Chamber Storage
322 Chambers x 22.4 cf = 7,219.9 cf Displacement

12,592.3 cf Field - 7,219.9 cf Chambers = 5,372.5 cf Stone x 40.0% Voids = 2,149.0 cf Stone Storage

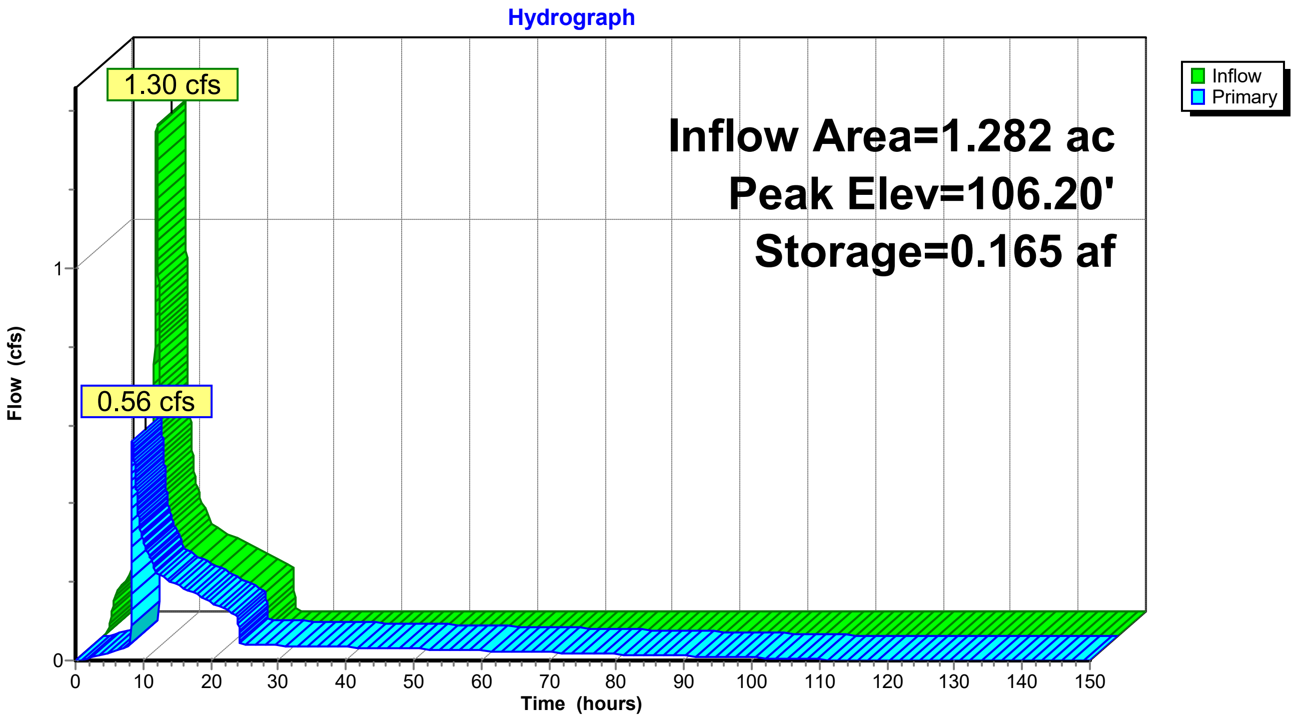
Chamber Storage + Stone Storage = 9,007.9 cf = 0.207 af
Overall Storage Efficiency = 71.5%
Overall System Size = 111.91' x 13.19' x 8.53'

322 Chambers
466.4 cy Field
199.0 cy Stone





Pond CP: R-tank - Basin C



Summary for Pond DP: R-tank - Basin D

Inflow Area = 2.183 ac, 76.16% Impervious, Inflow Depth = 4.07" for 100-YR event
Inflow = 2.17 cfs @ 7.91 hrs, Volume= 0.740 af
Outflow = 0.84 cfs @ 8.67 hrs, Volume= 0.733 af, Atten= 62%, Lag= 46.1 min
Primary = 0.84 cfs @ 8.67 hrs, Volume= 0.733 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.21' @ 8.67 hrs Surf.Area= 0.057 ac Storage= 0.282 af

Plug-Flow detention time= 1,139.2 min calculated for 0.733 af (99% of inflow)
Center-of-Mass det. time= 1,133.1 min (1,809.6 - 676.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.082 af	**13.19'W x 189.32'L x 8.53'H Field A** 0.489 af Overall - 0.285 af Embedded = 0.204 af x 40.0% Voids
#2A	100.00'	0.270 af	**Ferguson R-Tank SD 10** x 553 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 553 Chambers in 7 Rows
		0.352 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**1.0" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.84 cfs @ 8.67 hrs HW=106.21' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.84 cfs of 15.70 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.07 cfs @ 11.96 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.77 cfs @ 1.62 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond DP: R-tank - Basin D - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

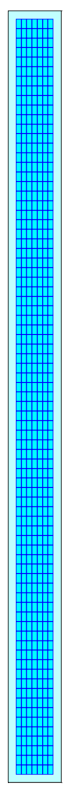
79 Chambers/Row x 2.35' Long = 185.32' Row Length +24.0" End Stone x 2 = 189.32' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

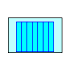
553 Chambers x 21.3 cf = 11,779.4 cf Chamber Storage
553 Chambers x 22.4 cf = 12,399.4 cf Displacement

21,303.1 cf Field - 12,399.4 cf Chambers = 8,903.7 cf Stone x 40.0% Voids = 3,561.5 cf Stone Storage

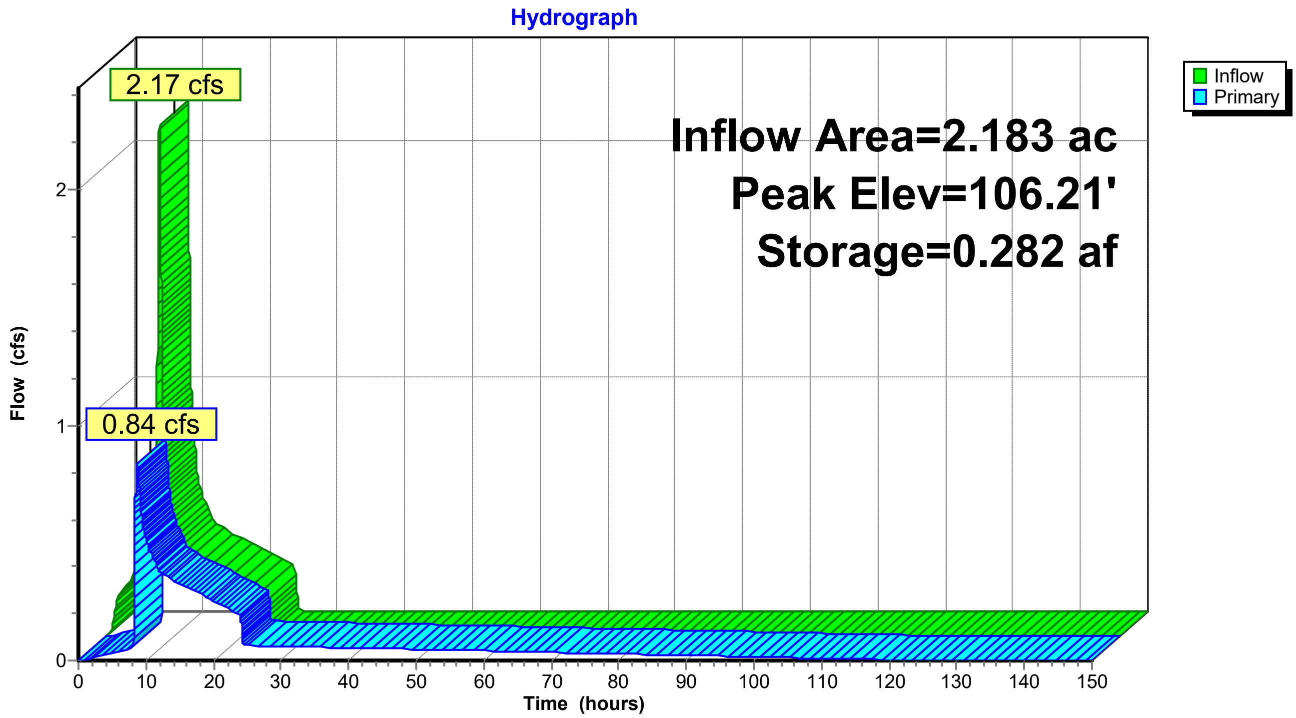
Chamber Storage + Stone Storage = 15,340.9 cf = 0.352 af
Overall Storage Efficiency = 72.0%
Overall System Size = 189.32' x 13.19' x 8.53'

553 Chambers
789.0 cy Field
329.8 cy Stone





Pond DP: R-tank - Basin D



Summary for Pond EP: R-tank - Basin E

Inflow Area = 1.629 ac, 74.48% Impervious, Inflow Depth = 4.03" for 100-YR event
Inflow = 1.61 cfs @ 7.91 hrs, Volume= 0.548 af
Outflow = 0.52 cfs @ 9.00 hrs, Volume= 0.495 af, Atten= 68%, Lag= 65.4 min
Primary = 0.52 cfs @ 9.00 hrs, Volume= 0.495 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.15' @ 9.00 hrs Surf.Area= 0.048 ac Storage= 0.234 af

Plug-Flow detention time= 1,653.4 min calculated for 0.495 af (90% of inflow)
Center-of-Mass det. time= 1,584.8 min (2,262.8 - 678.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.069 af	**13.19'W x 158.82'L x 8.53'H Field A** 0.410 af Overall - 0.238 af Embedded = 0.172 af x 40.0% Voids
#2A	100.00'	0.226 af	**Ferguson R-Tank SD 10** x 462 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 462 Chambers in 7 Rows
		0.295 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.6" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**2.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**24.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.52 cfs @ 9.00 hrs HW=106.15' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.52 cfs of 15.61 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.02 cfs @ 11.92 fps)
  ├─**3=Sharp-Crested Rectangular Weir** (Weir Controls 0.50 cfs @ 1.39 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond EP: R-tank - Basin E - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

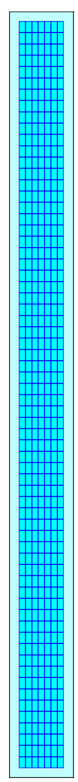
66 Chambers/Row x 2.35' Long = 154.82' Row Length +24.0" End Stone x 2 = 158.82' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

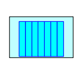
462 Chambers x 21.3 cf = 9,841.0 cf Chamber Storage
462 Chambers x 22.4 cf = 10,359.0 cf Displacement

17,871.6 cf Field - 10,359.0 cf Chambers = 7,512.6 cf Stone x 40.0% Voids = 3,005.0 cf Stone Storage

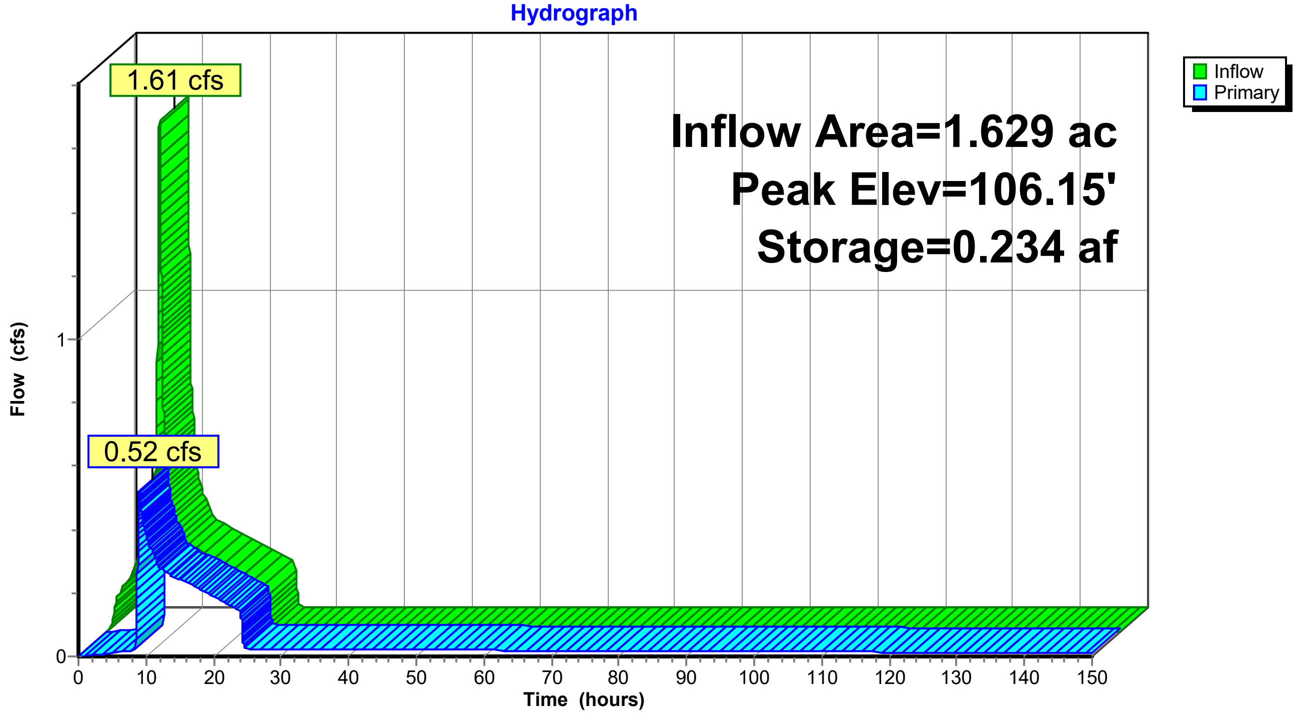
Chamber Storage + Stone Storage = 12,846.1 cf = 0.295 af
Overall Storage Efficiency = 71.9%
Overall System Size = 158.82' x 13.19' x 8.53'

462 Chambers
661.9 cy Field
278.2 cy Stone





Pond EP: R-tank - Basin E



Summary for Pond FP: R-tank - Basin F

Inflow Area = 0.998 ac, 82.99% Impervious, Inflow Depth = 4.19" for 100-YR event
Inflow = 1.03 cfs @ 7.90 hrs, Volume= 0.349 af
Outflow = 0.40 cfs @ 8.65 hrs, Volume= 0.346 af, Atten= 61%, Lag= 44.6 min
Primary = 0.40 cfs @ 8.65 hrs, Volume= 0.346 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 106.15' @ 8.65 hrs Surf.Area= 0.028 ac Storage= 0.136 af

Plug-Flow detention time= 1,166.6 min calculated for 0.346 af (99% of inflow)
Center-of-Mass det. time= 1,160.5 min (1,830.9 - 670.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	99.75'	0.041 af	**13.19'W x 93.14'L x 8.53'H Field A** 0.241 af Overall - 0.137 af Embedded = 0.104 af x 40.0% Voids
#2A	100.00'	0.130 af	**Ferguson R-Tank SD 10** x 266 Inside #1 Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf 266 Chambers in 7 Rows
		0.172 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	100.00'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 100.00' / 99.90' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	100.00'	**0.7" Vert. Primary Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 1	105.97'	**1.5' long Weir** 2 End Contraction(s)
#4	Device 1	106.30'	**12.0" Horiz. Overflow Riser** C= 0.600

Primary OutFlow Max=0.40 cfs @ 8.65 hrs HW=106.15' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.40 cfs of 15.61 cfs potential flow)
  ├─**2=Primary Orifice** (Orifice Controls 0.03 cfs @ 11.91 fps)
  ├─**3=Weir** (Weir Controls 0.36 cfs @ 1.39 fps)
  └─**4=Overflow Riser** (Controls 0.00 cfs)

Pond FP: R-tank - Basin F - Chamber Wizard Field A

Chamber Model = Ferguson R-Tank SD 10 (Ferguson R-Tank SD)
Inside= 15.7"W x 87.4"H => 9.08 sf x 2.35'L = 21.3 cf
Outside= 15.7"W x 87.4"H => 9.56 sf x 2.35'L = 22.4 cf

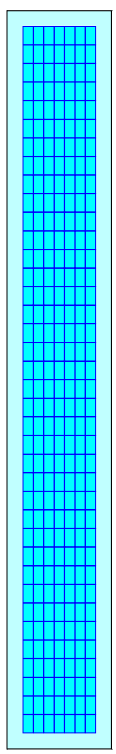
38 Chambers/Row x 2.35' Long = 89.14' Row Length +24.0" End Stone x 2 = 93.14' Base Length
7 Rows x 15.7" Wide + 24.0" Side Stone x 2 = 13.19' Base Width
3.0" Stone Base + 87.4" Chamber Height + 12.0" Stone Cover = 8.53' Field Height

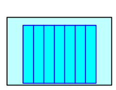
266 Chambers x 21.3 cf = 5,666.0 cf Chamber Storage
266 Chambers x 22.4 cf = 5,964.2 cf Displacement

10,480.7 cf Field - 5,964.2 cf Chambers = 4,516.4 cf Stone x 40.0% Voids = 1,806.6 cf Stone Storage

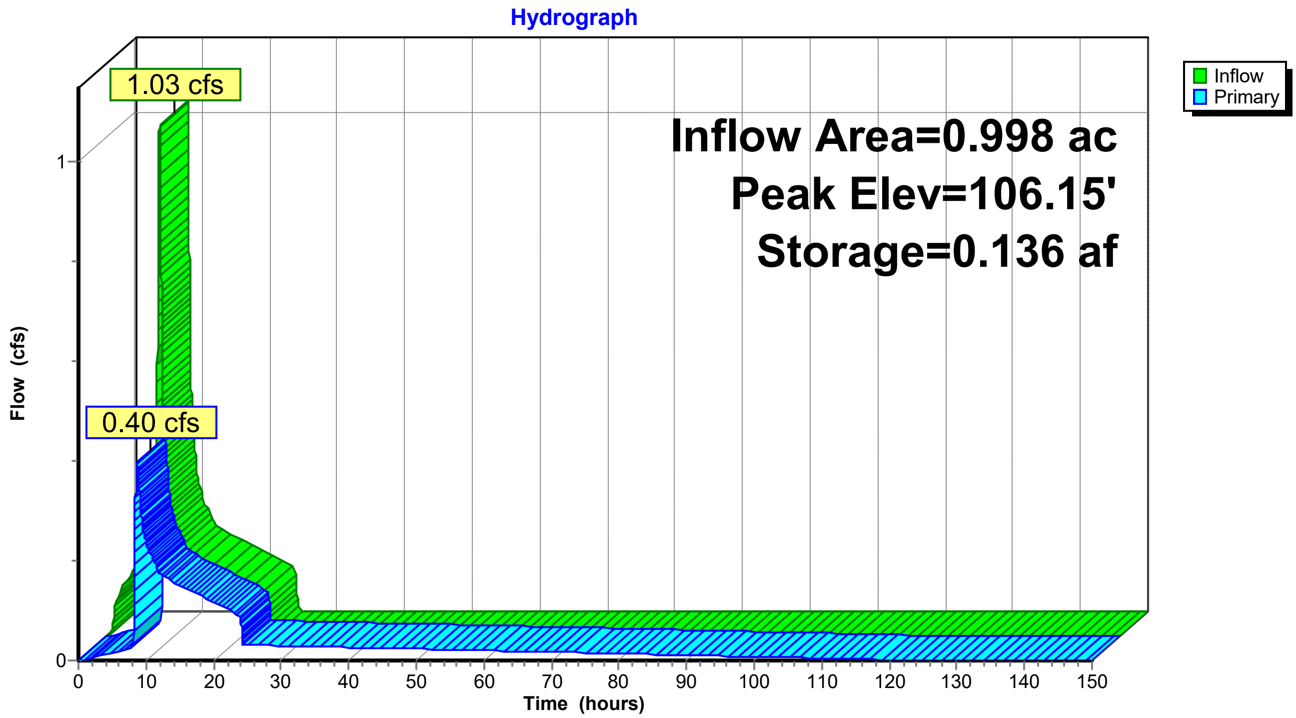
Chamber Storage + Stone Storage = 7,472.6 cf = 0.172 af
Overall Storage Efficiency = 71.3%
Overall System Size = 93.14' x 13.19' x 8.53'

266 Chambers
388.2 cy Field
167.3 cy Stone





Pond FP: R-tank - Basin F



Summary for Pond GP: Planter - Basin G

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 0.445 ac, 92.02% Impervious, Inflow Depth = 4.36" for 100-YR event
Inflow = 0.48 cfs @ 7.90 hrs, Volume= 0.162 af
Outflow = 0.18 cfs @ 8.70 hrs, Volume= 0.160 af, Atten= 63%, Lag= 48.1 min
Primary = 0.18 cfs @ 8.70 hrs, Volume= 0.160 af
Routed to Link PR : Combined - PostDev

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 100.90' @ 8.70 hrs Surf.Area= 2,320 sf Storage= 2,905 cf

Plug-Flow detention time= 1,547.7 min calculated for 0.160 af (99% of inflow)
Center-of-Mass det. time= 1,540.1 min (2,203.0 - 662.9)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	2,320 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,856 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 4,640 cf Overall x 40.0% Voids
		4,176 cf	Total Available Storage

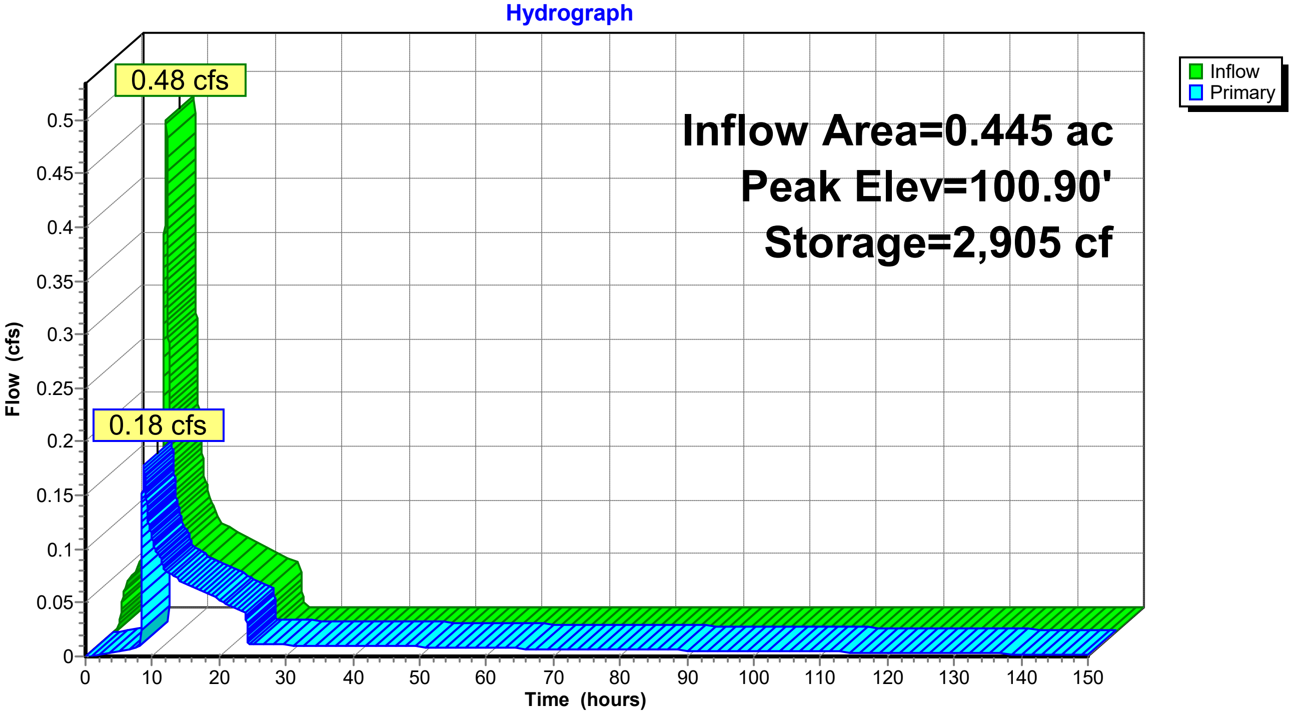
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	1,160	0	0
102.00	1,160	2,320	2,320

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	1,160	0	0
98.25	1,160	4,640	4,640

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.84'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.18 cfs @ 8.70 hrs HW=100.90' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 0.18 cfs of 16.32 cfs potential flow)
  ├─**3=Orifice A** (Orifice Controls 0.01 cfs @ 12.41 fps)
  │ ├─**2=Beehive OF** (Controls 0.00 cfs)
  │ └─**4=Underdrain** (Passes 0.01 cfs of 2.39 cfs potential flow)
  └─**5=Orifice B** (Weir Controls 0.17 cfs @ 0.83 fps)

Pond GP: Planter - Basin G



Summary for Pond HP: Planter - Basin H

[42] Hint: Gap in defined storage above volume #2 at 98.25'

```
Inflow Area =       0.339 ac, 86.24% Impervious, Inflow Depth =  4.25"   for 100-YR event
Inflow      =       0.35 cfs @   7.90 hrs, Volume=         0.120 af
Outflow     =       0.18 cfs @   8.32 hrs, Volume=         0.120 af, Atten= 50%, Lag= 25.0 min
Primary     =       0.18 cfs @   8.32 hrs, Volume=         0.120 af
    Routed to Link PR : Combined - PostDev
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 101.02' @ 8.32 hrs Surf.Area= 1,476 sf Storage= 1,936 cf

Plug-Flow detention time= 1,082.3 min calculated for 0.120 af (100% of inflow)
Center-of-Mass det. time= 1,082.6 min (1,750.2 - 667.6)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,476 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	1,181 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 2,952 cf Overall x 40.0% Voids
		2,657 cf	Total Available Storage

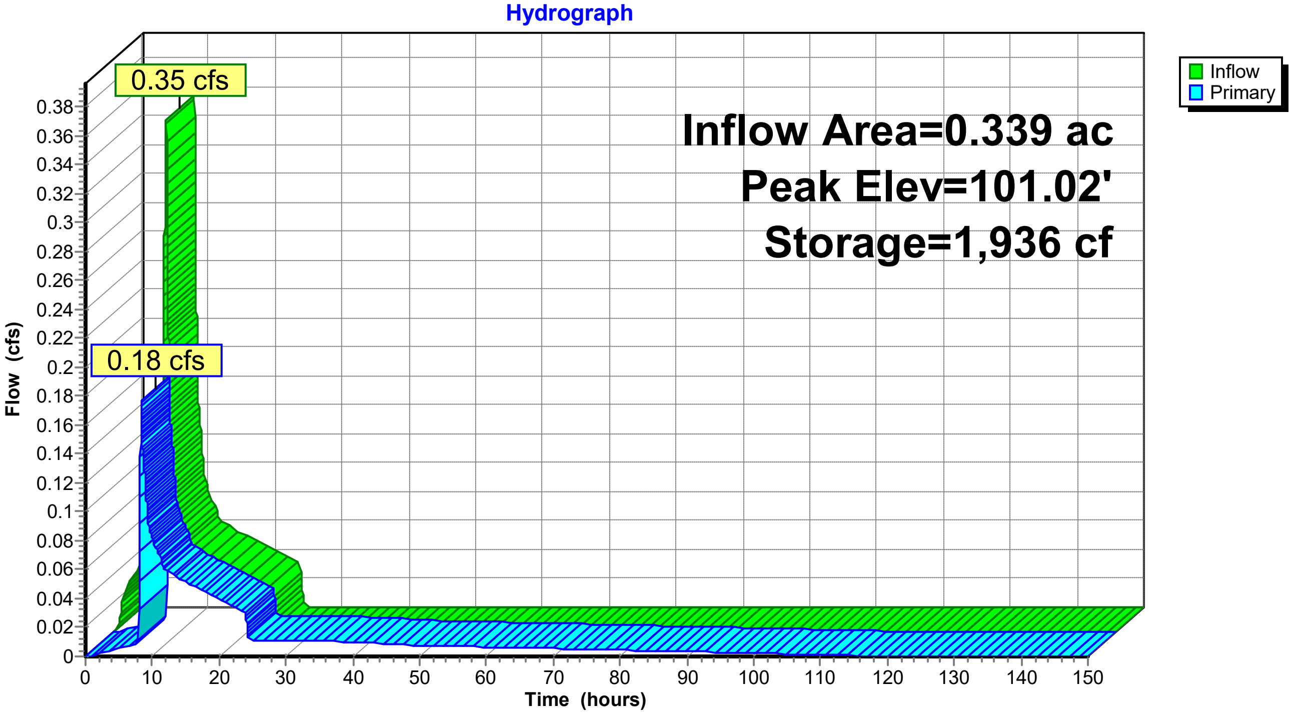
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	738	0	0
102.00	738	1,476	1,476

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	738	0	0
98.25	738	2,952	2,952

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**0.4" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	100.96'	**12.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.18 cfs @ 8.32 hrs HW=101.02' TW=0.00' (Dynamic Tailwater)
1=Culvert (Passes 0.18 cfs of 16.49 cfs potential flow)
  3=Orifice A (Orifice Controls 0.01 cfs @ 12.52 fps)
    2=Beehive OF (Controls 0.00 cfs)
    4=Underdrain (Passes 0.01 cfs of 2.41 cfs potential flow)
  5=Orifice B (Weir Controls 0.17 cfs @ 0.83 fps)

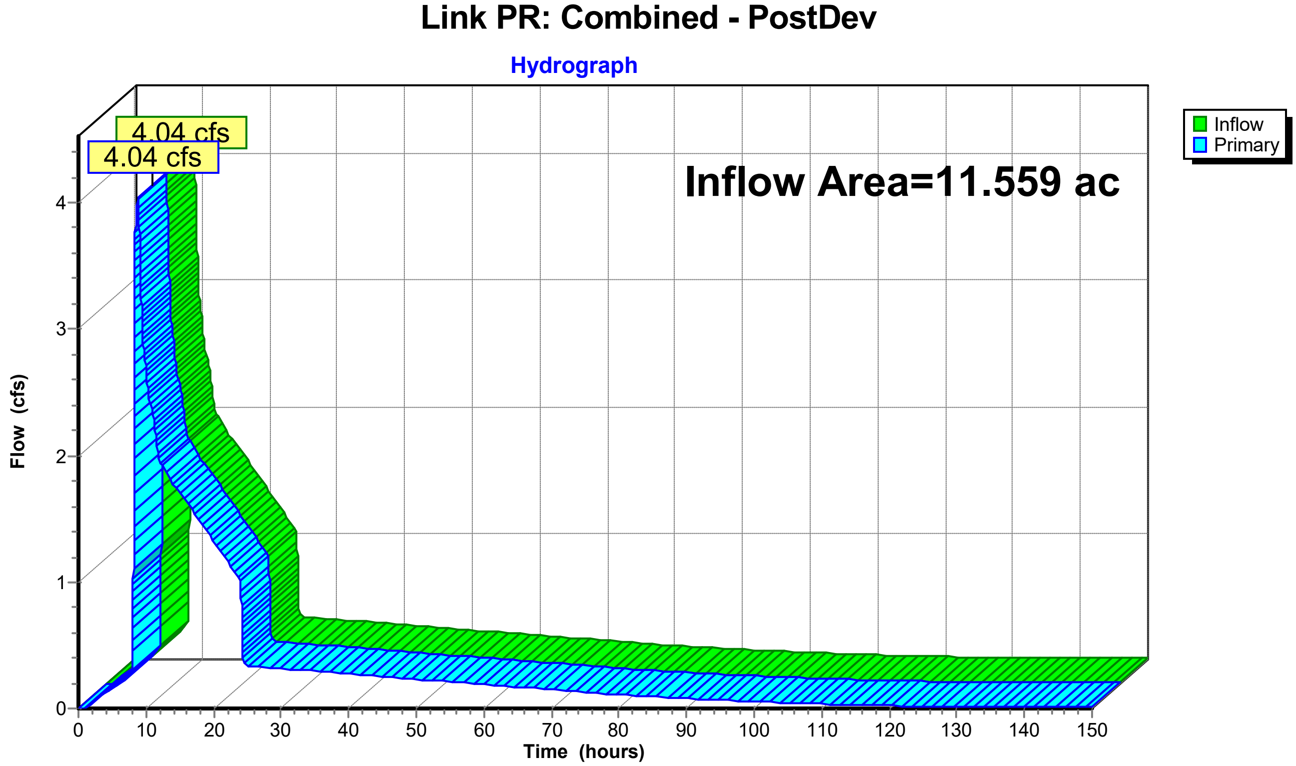
Pond HP: Planter - Basin H

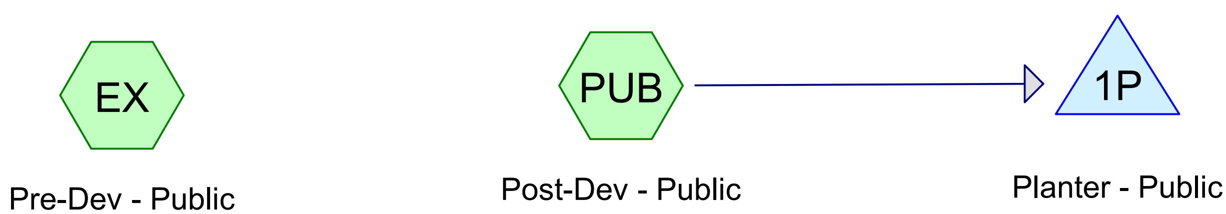


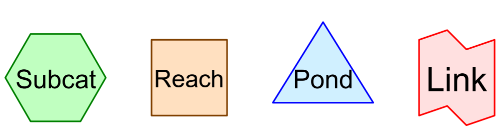
Summary for Link PR: Combined - PostDev

Inflow Area =	11.559 ac,	69.42% Impervious,	Inflow Depth > 3.86"	for 100-YR event
Inflow =	4.04 cfs @	8.79 hrs, Volume=	3.721 af	
Primary =	4.04 cfs @	8.79 hrs, Volume=	3.721 af,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs







Routing Diagram for MCR01 - Public HydroCAD
Prepared by Harper Houf Peterson Righells, Printed 5/22/2026
HydroCAD® 10.20-8a s/n 12110 © 2025 HydroCAD Software Solutions LLC

Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX: Pre-Dev - Public Runoff Area=92,378 sf 0.00% Impervious Runoff Depth=0.46"
Tc=10.0 min CN=70/0 Runoff=0.071 cfs 0.080 af

Subcatchment PUB: Post-Dev - Public Runoff Area=92,378 sf 79.29% Impervious Runoff Depth=1.98"
Tc=6.0 min CN=80/98 Runoff=1.034 cfs 0.351 af

Pond 1P: Planter - Public Peak Elev=101.41' Storage=10,890 cf Inflow=1.034 cfs 0.351 af
Outflow=0.070 cfs 0.351 af

Total Runoff Area = 4.241 ac Runoff Volume = 0.431 af Average Runoff Depth = 1.22"
60.35% Pervious = 2.560 ac 39.65% Impervious = 1.682 ac

Summary for Subcatchment EX: Pre-Dev - Public

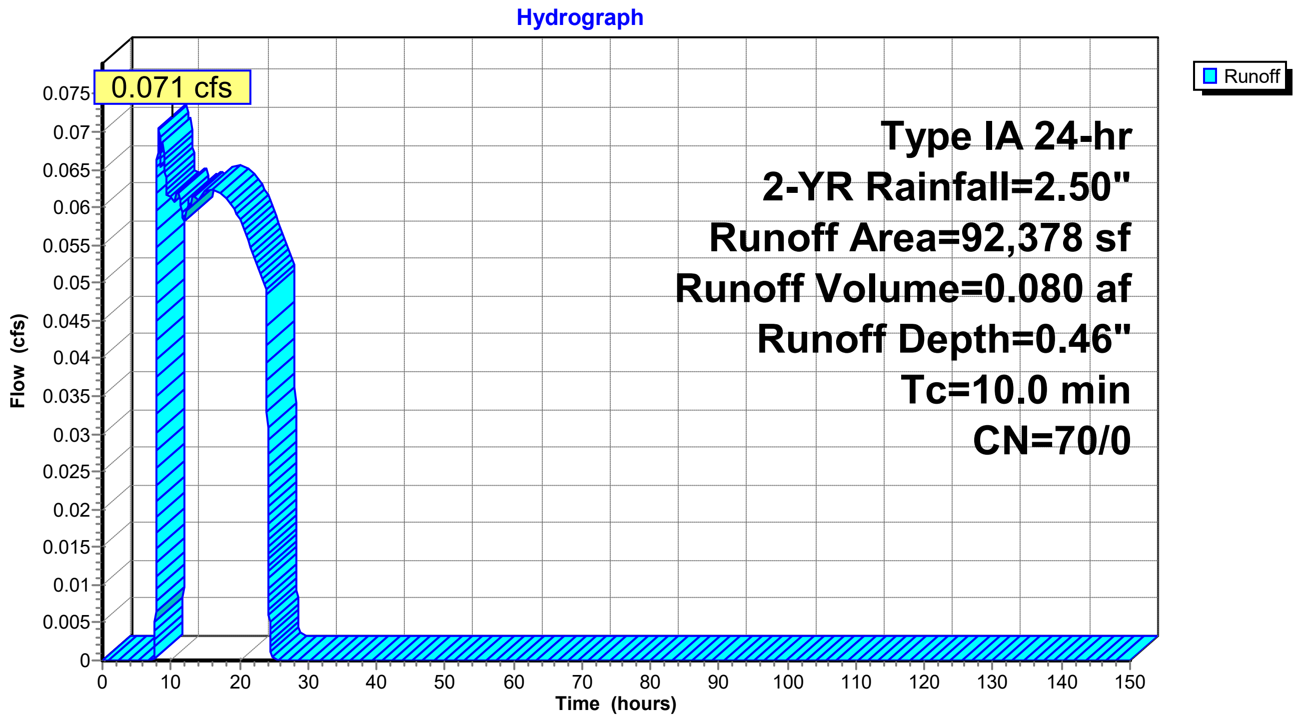
Runoff = 0.071 cfs @ 8.21 hrs, Volume= 0.080 af, Depth= 0.46"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	92,378	70	
	92,378	70	100.00% Pervious Area

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

Subcatchment EX: Pre-Dev - Public



Summary for Subcatchment PUB: Post-Dev - Public

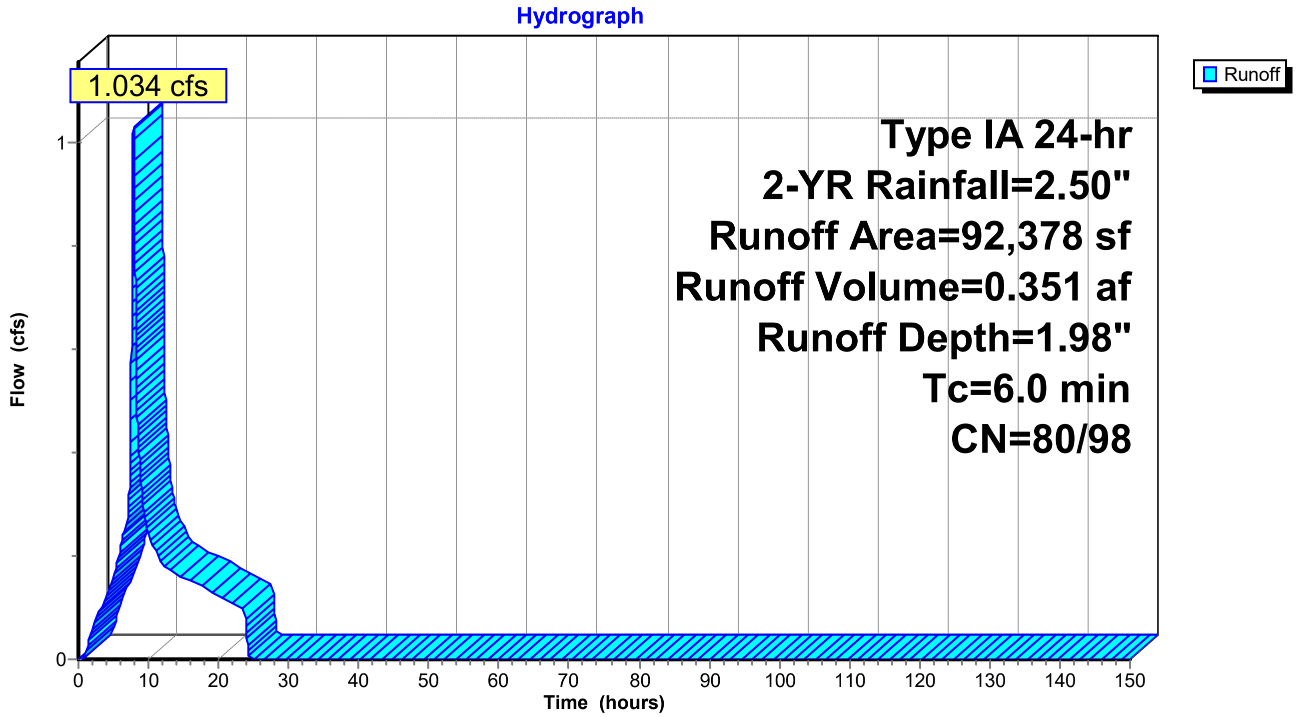
Runoff = 1.034 cfs @ 7.91 hrs, Volume= 0.351 af, Depth= 1.98"
Routed to Pond 1P : Planter - Public

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2-YR Rainfall=2.50"

	Area (sf)	CN	Description
*	73,251	98	
*	19,127	80	
	92,378	94	Weighted Average
	19,127	80	20.71% Pervious Area
	73,251	98	79.29% Impervious Area

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

Subcatchment PUB: Post-Dev - Public



Summary for Pond 1P: Planter - Public

[42] Hint: Gap in defined storage above volume #2 at 98.25'

```
Inflow Area =      2.121 ac, 79.29% Impervious, Inflow Depth =  1.98"   for 2-YR event
Inflow      =     1.034 cfs @   7.91 hrs, Volume=        0.351 af
Outflow     =     0.070 cfs @  24.04 hrs, Volume=        0.351 af, Atten= 93%, Lag= 967.4 min
Primary     =     0.070 cfs @  24.04 hrs, Volume=        0.351 af
    Routed to nonexistent node 1L
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 101.41' @ 24.04 hrs Surf.Area= 7,250 sf Storage= 10,890 cf

Plug-Flow detention time= 1,765.9 min calculated for 0.351 af (100% of inflow)
Center-of-Mass det. time= 1,765.5 min (2,455.6 - 690.1)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	7,300 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	5,760 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 14,400 cf Overall x 40.0% Voids
		13,060 cf	Total Available Storage

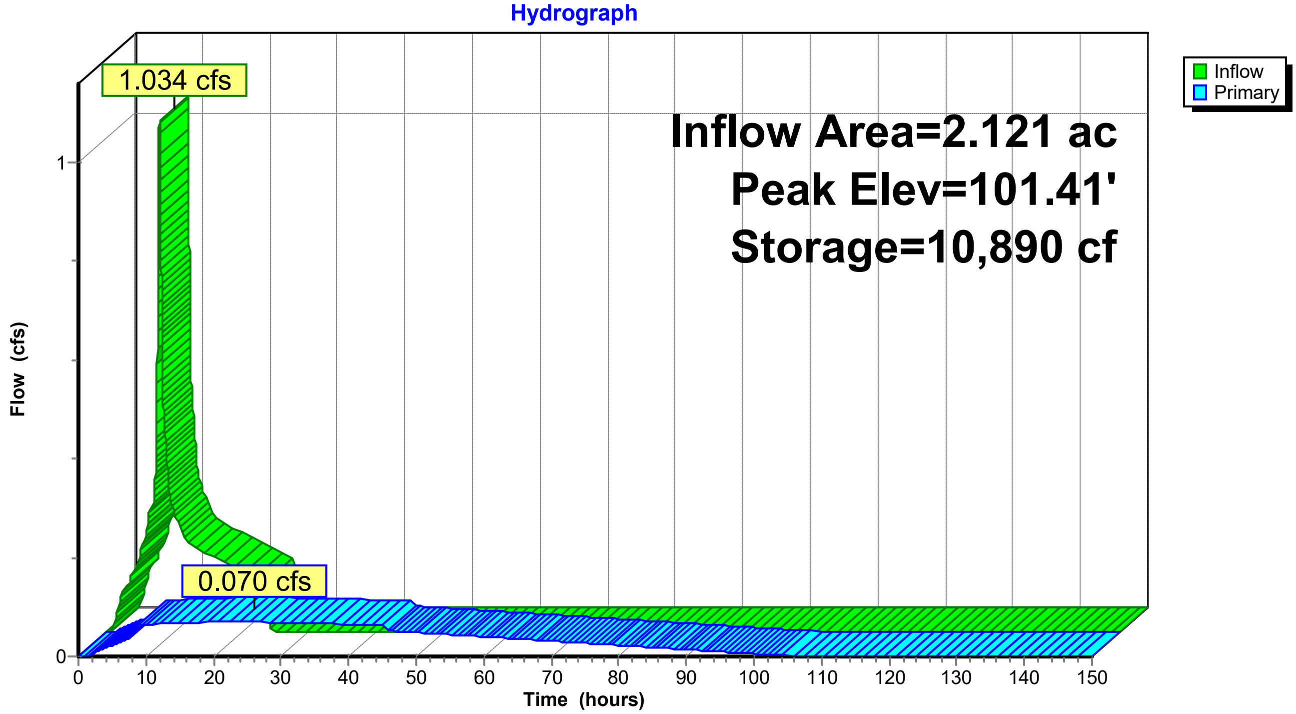
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	3,650	0	0
102.00	3,650	7,300	7,300

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	3,600	0	0
98.25	3,600	14,400	14,400

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**1.0" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	101.41'	**15.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.070 cfs @ 24.04 hrs HW=101.41' (Free Discharge)
└─**1=Culvert** (Passes 0.070 cfs of 17.001 cfs potential flow)
  ├─**3=Orifice A** (Orifice Controls 0.070 cfs @ 12.84 fps)
  │ ├─**2=Beehive OF** (Controls 0.000 cfs)
  │ └─**4=Underdrain** (Passes 0.070 cfs of 2.484 cfs potential flow)
  └─**5=Orifice B** (Controls 0.000 cfs)

Pond 1P: Planter - Public



Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX: Pre-Dev - Public Runoff Area=92,378 sf 0.00% Impervious Runoff Depth=0.98"
Tc=10.0 min CN=70/0 Runoff=0.317 cfs 0.173 af

Subcatchment PUB: Post-Dev - Public Runoff Area=92,378 sf 79.29% Impervious Runoff Depth=2.88"
Tc=6.0 min CN=80/98 Runoff=1.499 cfs 0.509 af

Pond 1P: Planter - Public Peak Elev=101.48' Storage=11,146 cf Inflow=1.499 cfs 0.509 af
Outflow=0.286 cfs 0.509 af

Total Runoff Area = 4.241 ac Runoff Volume = 0.682 af Average Runoff Depth = 1.93"
60.35% Pervious = 2.560 ac 39.65% Impervious = 1.682 ac

Summary for Subcatchment EX: Pre-Dev - Public

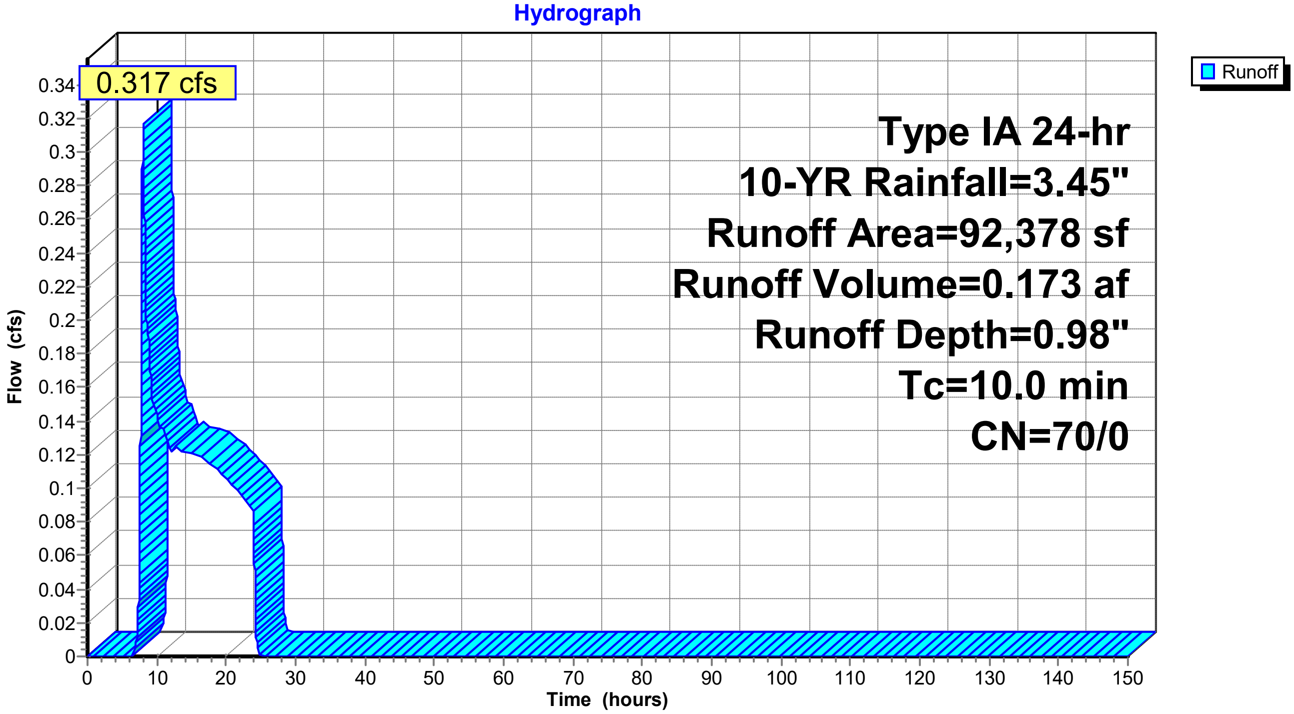
Runoff = 0.317 cfs @ 8.01 hrs, Volume= 0.173 af, Depth= 0.98"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	92,378	70	
	92,378	70	100.00% Pervious Area

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

Subcatchment EX: Pre-Dev - Public



Summary for Subcatchment PUB: Post-Dev - Public

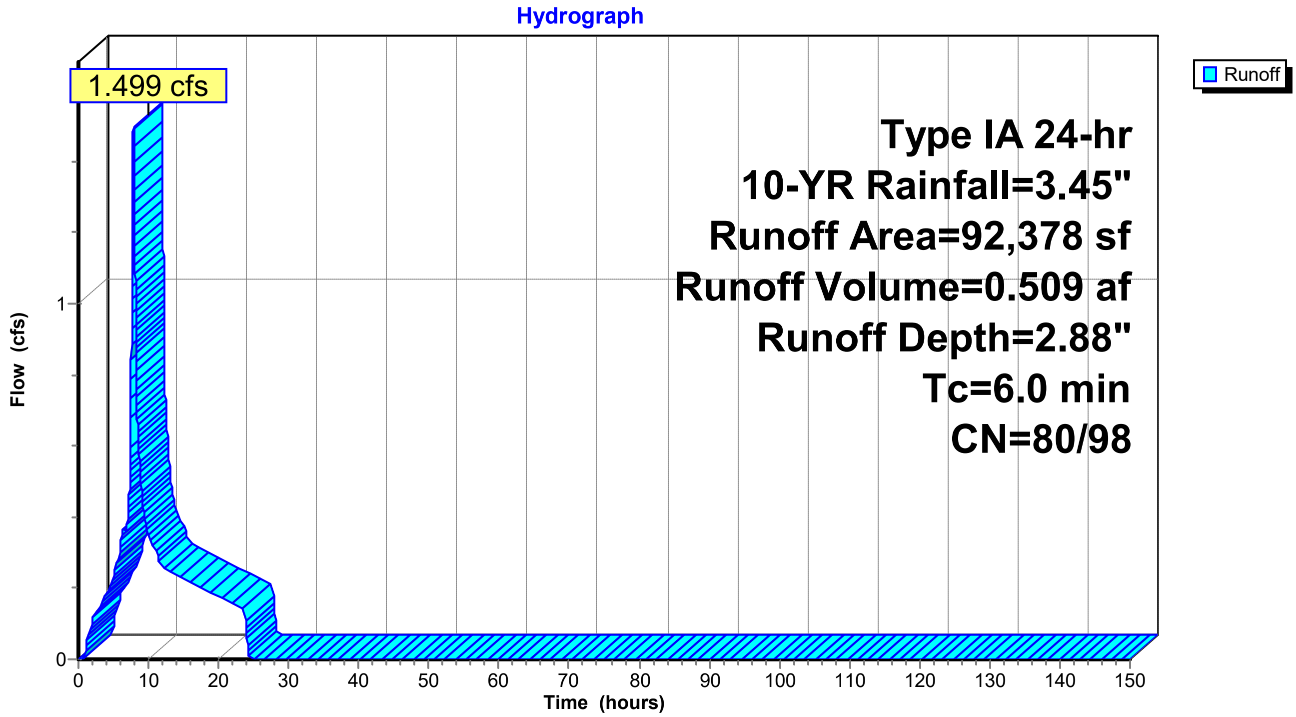
Runoff = 1.499 cfs @ 7.91 hrs, Volume= 0.509 af, Depth= 2.88"
Routed to Pond 1P : Planter - Public

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10-YR Rainfall=3.45"

	Area (sf)	CN	Description
*	73,251	98	
*	19,127	80	
	92,378	94	Weighted Average
	19,127	80	20.71% Pervious Area
	73,251	98	79.29% Impervious Area

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

Subcatchment PUB: Post-Dev - Public



Summary for Pond 1P: Planter - Public

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 2.121 ac, 79.29% Impervious, Inflow Depth = 2.88" for 10-YR event
Inflow = 1.499 cfs @ 7.91 hrs, Volume= 0.509 af
Outflow = 0.286 cfs @ 11.34 hrs, Volume= 0.509 af, Atten= 81%, Lag= 206.1 min
Primary = 0.286 cfs @ 11.34 hrs, Volume= 0.509 af
Routed to nonexistent node 1L

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 101.48' @ 11.34 hrs Surf.Area= 7,250 sf Storage= 11,146 cf

Plug-Flow detention time= 1,320.4 min calculated for 0.509 af (100% of inflow)
Center-of-Mass det. time= 1,320.5 min (2,001.8 - 681.3)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	7,300 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	5,760 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 14,400 cf Overall x 40.0% Voids
		13,060 cf	Total Available Storage

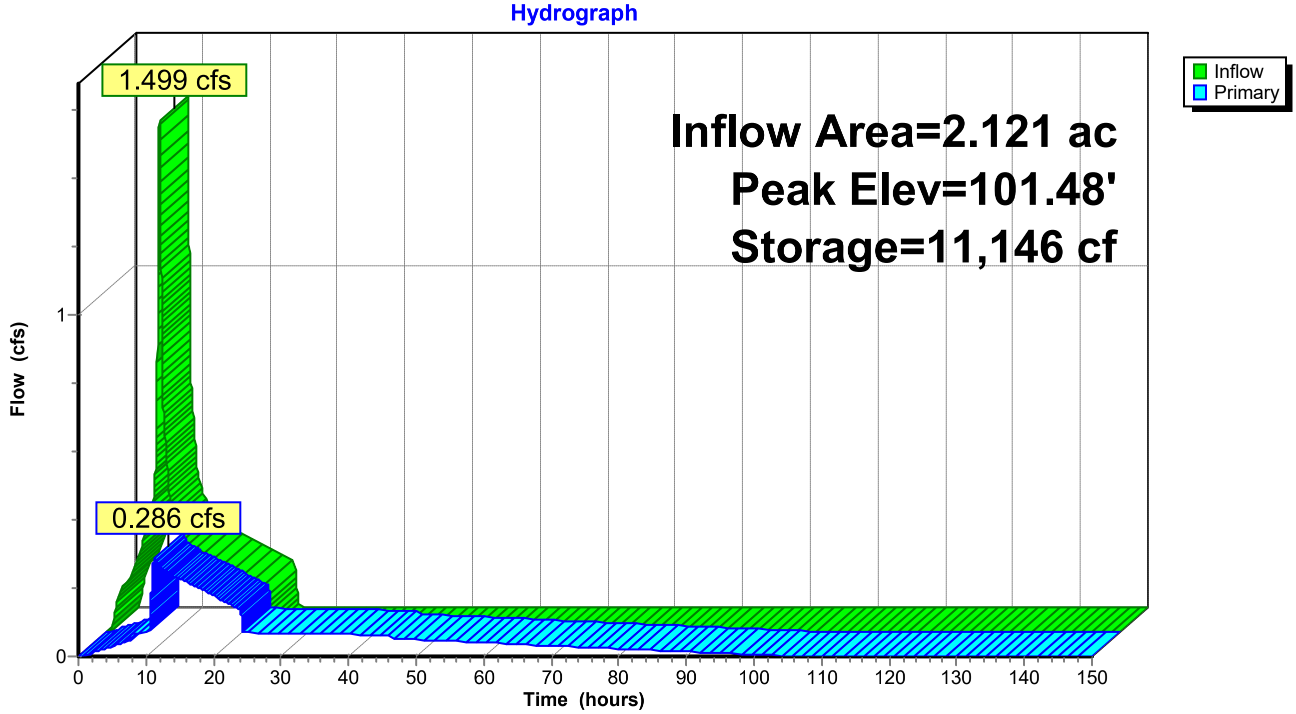
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	3,650	0	0
102.00	3,650	7,300	7,300

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	3,600	0	0
98.25	3,600	14,400	14,400

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**1.0" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	101.41'	**15.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.286 cfs @ 11.34 hrs HW=101.48' (Free Discharge)
└─**1=Culvert** (Passes 0.286 cfs of 17.094 cfs potential flow)
  ├─**3=Orifice A** (Orifice Controls 0.070 cfs @ 12.91 fps)
  │ ├─**2=Beehive OF** (Controls 0.000 cfs)
  │ └─**4=Underdrain** (Passes 0.070 cfs of 2.497 cfs potential flow)
  └─**5=Orifice B** (Weir Controls 0.215 cfs @ 0.84 fps)

Pond 1P: Planter - Public



Time span=0.00-150.00 hrs, dt=0.01 hrs, 15001 points x 3
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX: Pre-Dev - Public Runoff Area=92,378 sf 0.00% Impervious Runoff Depth=1.26"
Tc=10.0 min CN=70/0 Runoff=0.462 cfs 0.223 af

Subcatchment PUB: Post-Dev - Public Runoff Area=92,378 sf 79.29% Impervious Runoff Depth=3.31"
Tc=6.0 min CN=80/98 Runoff=1.723 cfs 0.585 af

Pond 1P: Planter - Public Peak Elev=101.50' Storage=11,236 cf Inflow=1.723 cfs 0.585 af
Outflow=0.418 cfs 0.585 af

Total Runoff Area = 4.241 ac Runoff Volume = 0.809 af Average Runoff Depth = 2.29"
60.35% Pervious = 2.560 ac 39.65% Impervious = 1.682 ac

Summary for Subcatchment EX: Pre-Dev - Public

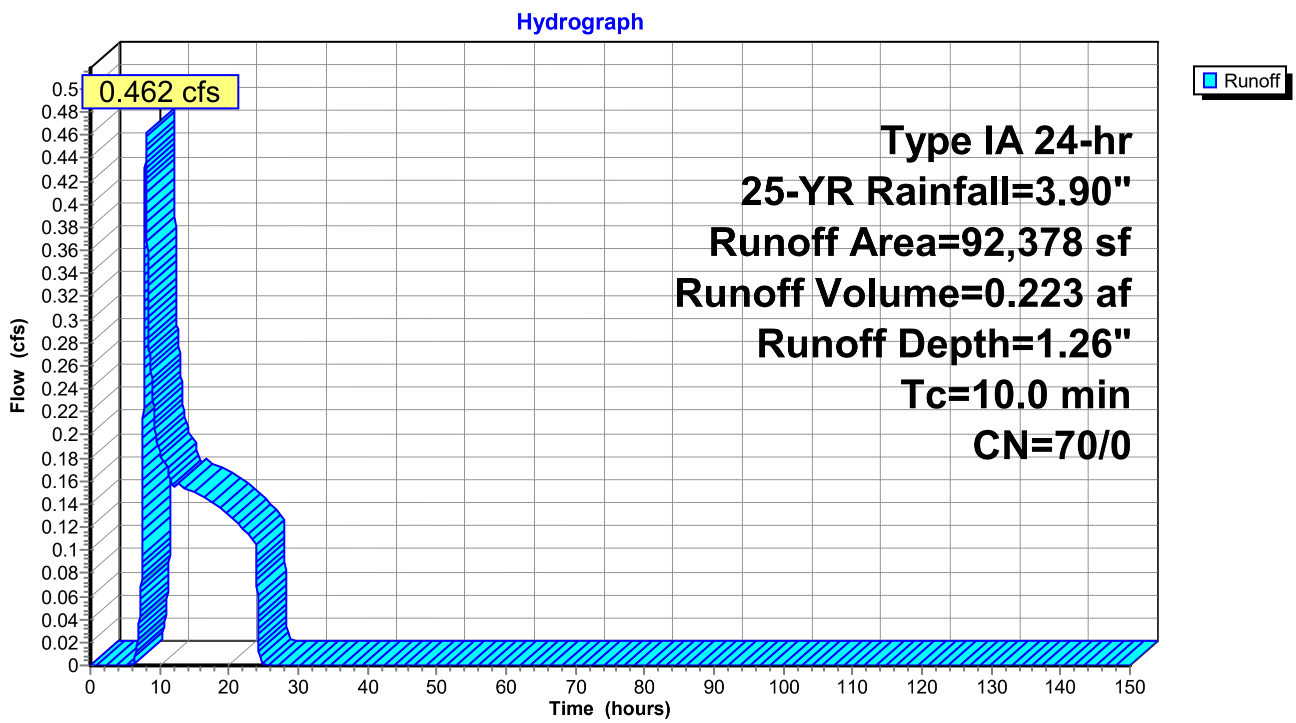
Runoff = 0.462 cfs @ 8.00 hrs, Volume= 0.223 af, Depth= 1.26"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	92,378	70	
	92,378	70	100.00% Pervious Area

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

Subcatchment EX: Pre-Dev - Public



Summary for Subcatchment PUB: Post-Dev - Public

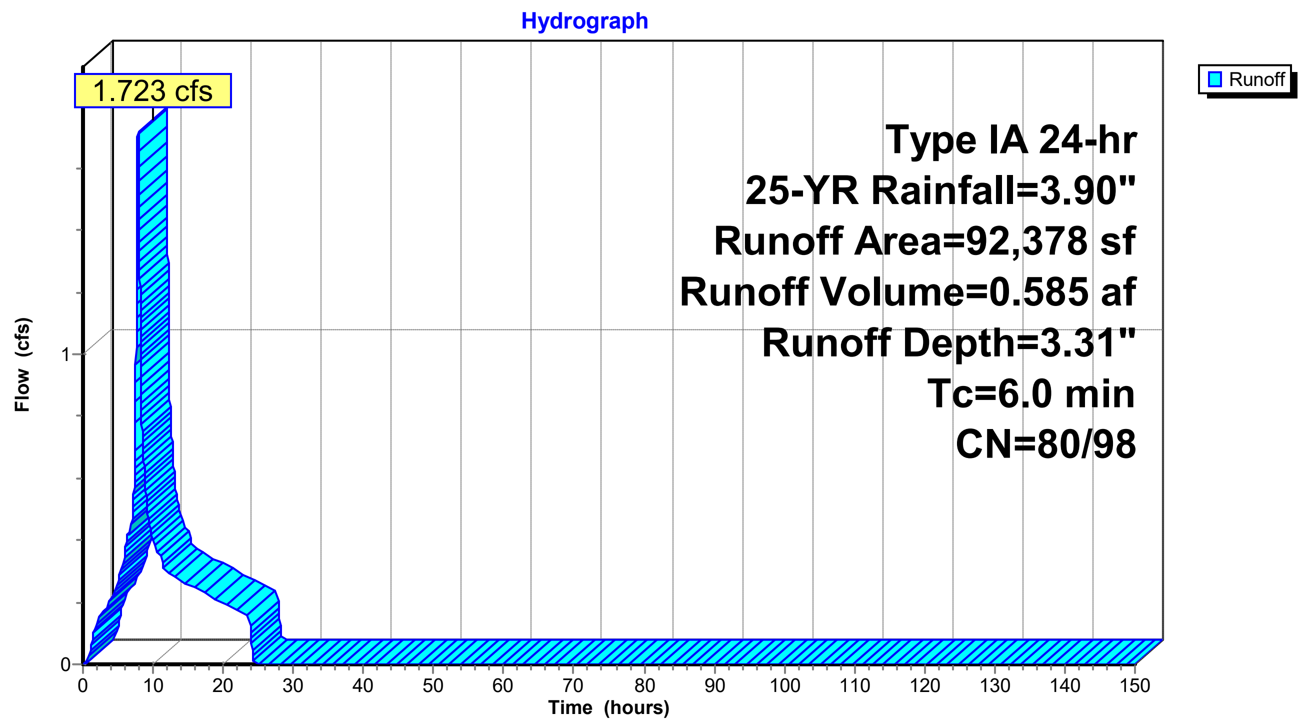
Runoff = 1.723 cfs @ 7.91 hrs, Volume= 0.585 af, Depth= 3.31"
Routed to Pond 1P : Planter - Public

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-150.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25-YR Rainfall=3.90"

	Area (sf)	CN	Description
*	73,251	98	
*	19,127	80	
	92,378	94	Weighted Average
	19,127	80	20.71% Pervious Area
	73,251	98	79.29% Impervious Area

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

Subcatchment PUB: Post-Dev - Public



Summary for Pond 1P: Planter - Public

[42] Hint: Gap in defined storage above volume #2 at 98.25'

Inflow Area = 2.121 ac, 79.29% Impervious, Inflow Depth = 3.31" for 25-YR event
Inflow = 1.723 cfs @ 7.91 hrs, Volume= 0.585 af
Outflow = 0.418 cfs @ 9.80 hrs, Volume= 0.585 af, Atten= 76%, Lag= 113.9 min
Primary = 0.418 cfs @ 9.80 hrs, Volume= 0.585 af
Routed to nonexistent node 1L

Routing by Dyn-Stor-Ind method, Time Span= 0.00-150.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 101.50' @ 9.80 hrs Surf.Area= 7,250 sf Storage= 11,236 cf

Plug-Flow detention time= 1,163.9 min calculated for 0.585 af (100% of inflow)
Center-of-Mass det. time= 1,163.7 min (1,841.9 - 678.3)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	7,300 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	94.25'	5,760 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 14,400 cf Overall x 40.0% Voids
		13,060 cf	Total Available Storage

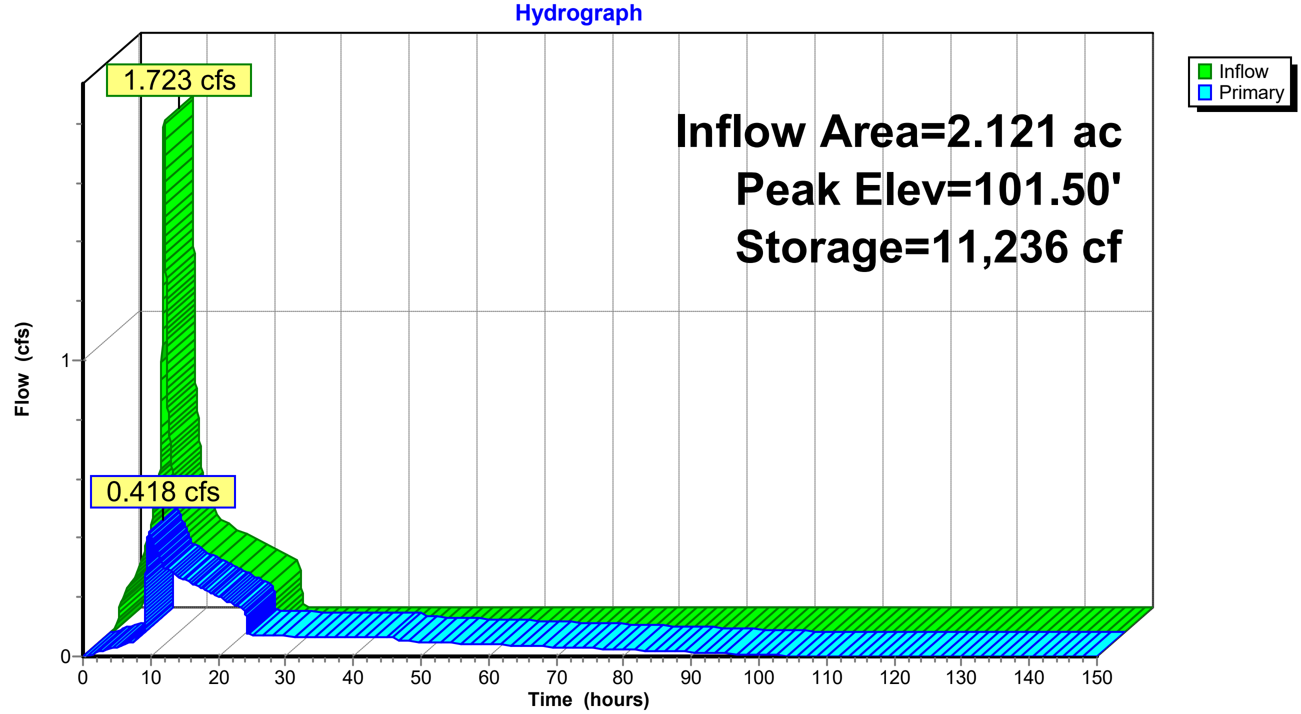
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	3,650	0	0
102.00	3,650	7,300	7,300

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
94.25	3,600	0	0
98.25	3,600	14,400	14,400

Device	Routing	Invert	Outlet Devices
#1	Primary	94.25'	**18.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 94.25' / 93.25' S= 0.1000 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 3	101.50'	**24.0" Horiz. Beehive OF** C= 0.600 Limited to weir flow at low heads
#3	Device 1	94.25'	**1.0" Vert. Orifice A** C= 0.600 Limited to weir flow at low heads
#4	Device 3	94.25'	**6.0" Vert. Underdrain** C= 0.600 Limited to weir flow at low heads
#5	Device 1	101.41'	**15.0" Horiz. Orifice B** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.418 cfs @ 9.80 hrs HW=101.50' (Free Discharge)
└─**1=Culvert** (Passes 0.418 cfs of 17.126 cfs potential flow)
  ├─**3=Orifice A** (Orifice Controls 0.071 cfs @ 12.93 fps)
  │ ├─**2=Beehive OF** (Passes < 0.000 cfs potential flow)
  │ └─**4=Underdrain** (Passes < 2.501 cfs potential flow)
  └─**5=Orifice B** (Weir Controls 0.348 cfs @ 0.98 fps)

Pond 1P: Planter - Public



APPENDIX E

CONVEYANCE CALCULATIONS

APPENDIX F

DOWNSTREAM ANALYSIS

APPENDIX G

GEOTECHNICAL REPORT

Report of Geotechnical Engineering Services

Modera West Linn

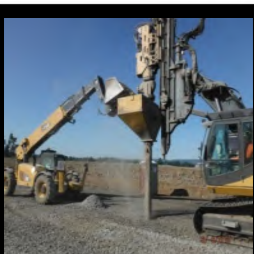
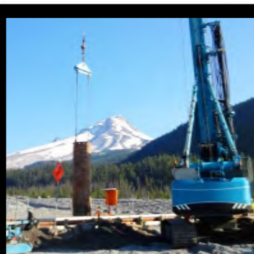
West Linn, Oregon

September 16, 2025

Geotechnical ■ Environmental ■ Special Inspections

Columbia West

Engineering, Inc

www.columbia-west.com

Geotechnical ■ Environmental ■ Special Inspections
Columbia West Engineering, Inc

Vancouver, Washington • Phone: 360-823-2900
Portland, Oregon • Phone: 971-384-1666
www.columbia-west.com

September 16, 2025

MCRT Investments LLC
720 SW Washington Street, Suite 720
Portland, OR 97205

Attention: Chad Encinas

Re: Report of Geotechnical Engineering Services
Modera West Linn
Tannler Drive and Blankenship Road
West Linn, Oregon
CWE Project: MCRT-1-01-1

Columbia West Engineering, Inc. (Columbia West) is pleased to present this report of geotechnical engineering services for the Modera West Linn project located in West Linn, Oregon. Our services were conducted in accordance with the Professional Services Contract for Projects in Oregon between MCRT Investments LLC and Columbia West dated July 9, 2025.

We appreciate the opportunity to work on the project. Please contact us if you have any questions regarding this report.

Sincerely,

Najib A. Kalas, PE
Principal Engineer

Brett A. Shipton, PE, GE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
84829PE
OREGON
November 10, 2015
NAJIB A. KALAS
EXPIRES: 06/30/27

cc: Tim Urben, MCRT Investments LLC

GLW:NAK:BAS:kat
Attachments
Document ID: MCRT-1-01-1-091625-geor-rev.docx

EXECUTIVE SUMMARY

This executive summary presents the primary geotechnical considerations associated with the proposed Modera West Linn project located in West Linn, Oregon. Our conclusions and recommendations are based on the subsurface information presented in the report and proposed development information provided by the design team. Detailed discussion of the geotechnical considerations summarized here is presented in respective sections of the report.

- Shallow basalt bedrock was encountered at the site. The upper portion of the bedrock is weathered and decomposed and was possible to excavate using small excavator with a toothed bucket. The underlying intact bedrock could not be penetrated by the excavator, even with significant effort. Some site cuts are proposed below intact bedrock elevations, which will likely require specialized excavation methods such as hydraulic breakers, rock trenchers, or blasting.

- Contract bid documents should require that contractors list a unit cost for rock excavation using in-place (bank) volumes, which can be measured by surveying. The unit cost should not be provided in excavated (swelled) volumes, which are more difficult to accurately measure.

- Based on the results of our explorations and analysis, proposed structures can be supported by spread footings bearing on firm, native soil and rock or engineered structural fill overlying undisturbed native material. Differential settlement may result where buildings are founded partially on bedrock and partially on soil. Differential settlement can be minimized by use of compacted gravel pads for footings established over the native silt or gravelly soil. Our foundation recommendations are provided in Section 6.1 (Foundation Support).

- Floor slabs for some of the structures may also span soil and bedrock. There is a potential for differential settlement or reflection cracking of floor slabs along bedrock/soil interfaces. We recommend that the floor slab base section be increased to a minimum of 12 inches along such interfaces. More detailed recommendations are presented in Section 6.2 (Floor Slabs).

- Liquefaction, lateral spreading, and fault rupture are not considered hazards at the site.

- Near-surface, fined-grained soil is sensitive to disturbance and softening when at a moisture content that is above optimum. Granular access pads and staging areas will be necessary to minimize damage to exposed subgrade soil during construction. Subgrade protection is discussed in Section 7.2 (Construction Traffic and Staging).

- Moisture conditioning (drying) of on-site silt and gravelly soil will be required to use the material as structural fill. Accordingly, on-site soil will likely only be suitable for use as structural fill during the dry season.

- The on-site basalt can be used as general structural fill, provided it is adequately processed to smaller particles sizes and to a well-graded (non-uniform) state.

- Groundwater may become perched on the shallow bedrock during periods of persistent rainfall and may impact site cuts, retaining walls, and below-grade structures. Adequate drainage will be essential behind retaining walls to intercept perched groundwater flow and convey it away from proposed structures. Foundation perimeter drains will also be required where upslope footing excavations extend below the level of the basalt rock surface.

- The conceptual site and grading plan dated August 29, 2025, indicates that significant cuts of up to approximately 25 feet and associated retaining walls may be proposed at the site. Our scope of services did not include exploration of the intact basalt using rock coring techniques. For proposed cuts and walls exceeding 15 feet in height, we recommend additional exploration via rock coring to evaluate the presence of bedding planes and assess the feasibility of constructing large, over-steepened cuts into the rock. We should also be contacted to review site grading plans as they are developed to provide appropriate recommendations for additional exploration and analysis. Further, we recommend that site retaining walls be designed on a case-by-case basis with input from a qualified geotechnical engineer. Based on the current conceptual plan, we anticipate that up to three borings with rock coring to depths between approximately 25 and 35 feet BGS will be required.

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ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AC	asphalt concrete
ACP	asphalt concrete pavement
ASCE	American Society of Civil Engineers
ASTM	ASTM International
BGS	below ground surface
CRBG	Columbia River Basalt Group
g	gravitational acceleration (32.2 feet/second^2)
H:V	horizontal to vertical
km	kilometer(s)
MCE	maximum considered earthquake
OSHA	Occupational Safety and Health Administration
OSSC	2024 Oregon Standard Specifications for Construction
pcf	pounds per cubic foot
pci	pounds per cubic inch
PG	performance grade
psf	pounds per square foot
psi	pounds per square inch
SOSSC	State of Oregon Structural Specialty Code
USGS	U.S. Geological Survey
WGS 84	World Geodetic System 1984

REPORT OF GEOTECHNICAL ENGINEERING SERVICES
MODERA WEST LINN
WEST LINN, OREGON

1.0 INTRODUCTION

Columbia West is pleased to submit this report of geotechnical engineering services for the Modera West Linn project located in West Linn, Oregon. The 11.41-acre site is located northwest of the intersection of Tannler Drive and Blankenship Road. The site is shown relative to surrounding physical features on Figure 1. Existing conditions and current exploration locations are shown on Figure 2. A description of our field exploration program and the exploration logs are presented in Appendix A. A description of the laboratory testing program and the test results are presented in Appendix B. Prior explorations by others are presented in Appendix C. Abbreviations and acronyms used herein are defined immediately following the Table of Contents.

2.0 PROJECT UNDERSTANDING

The conceptual site and grading plan dated August 29, 2025, shown on Figure 3, indicates that the proposed development includes several up to four-story, wood-framed residential buildings; mixed-use residential and commercial buildings; a community center/clubhouse; carports; garages; and office buildings with associated infrastructure, including swimming pools, pavement, and utilities. Tannler Drive will be realigned to accommodate the proposed development.

Foundation loads were not available at the time of this report; however, we have assumed maximum column and wall loads will be less than 200 kips and less than 4.5 kips per lineal foot, respectively. We estimate the distributed slab live load is less than 100 psf. Preliminary spot-grading information provided by the design team indicates that deep cuts and associated retaining walls with exposed heights of up to approximately 25 feet are planned for the proposed development. Fills on the order of approximately 10 feet or more may also be proposed. We should be contacted to revise our recommendations if the assumptions stated above are incorrect.

3.0 BACKGROUND

In preparing this report, we reviewed the following documents that contain relevant information regarding the site:

- *Report of Geotechnical Engineering Services; Willamette 205 Corporate Center; Blankenship Road and Tannler Drive; West Linn, Oregon,* prepared by GeoDesign, Inc., dated July 7, 2006
- *Report of Geotechnical Engineering Services; NWC of Tannler & Blankenship; Tannler Drive and Blankenship Road; West Linn, Oregon,* prepared by GeoDesign, Inc., dated July 28, 2014

These investigations included 33 test pit excavations that were explored to depths between 3.3 and 13.5 feet BGS. In general, the prior test pit explorations encountered silt to varying depths overlying basalt bedrock. Layers of silty gravel and gravelly silt with cobbles were encountered between the silt and bedrock units in some test pits, which were interpreted as colluvium or decomposed bedrock. The upper portion of the underlying bedrock was described as decomposed to weathered and fractured and transitions to intact bedrock with depth. The ground surface was reported to be covered by an approximately 2- to 8-inch-thick root zone from surface vegetation. Abundant shrub roots were reportedly observed to depths of 12 to 18 inches. Slow to moderate groundwater seepage was reported in three of the test pits at depths between 3.5 and 10 feet BGS. The findings of our current subsurface exploration program are supplemented by the exploration logs from the 2006 and 2014 reports, which are presented in Appendix C.

4.0 PURPOSE AND SCOPE

The purpose of our services was to provide geotechnical engineering recommendations for use in design and construction of the proposed development. Specifically, we completed the following tasks:

- Reviewed information available in Columbia West's files from previous geological and geotechnical studies conducted at and in the vicinity of the site, including test pit logs and associated laboratory testing prepared by GeoDesign for the site in 2006 and 2014.
- Coordinated and managed the field exploration program, which included locating public and private utilities, coordinating site access, and scheduling subcontractors and Columbia West field staff.
- Excavated 10 test pits to depths between 2 and 6 feet BGS.
- Observed subsurface conditions, maintained continuous logs of the explorations, and collected samples at representative intervals.
- Completed a laboratory testing program using select soil samples collected from the explorations, which included the following:
  - Ten moisture content determinations in general accordance with ASTM D2216
  - Four particle-size analyses in general accordance with ASTM D1140
  - Two Atterberg limits tests in general accordance with ASTM D4318
- Prepared this geotechnical report that includes the following:
  - Summary of soil and groundwater conditions at the site
  - Assessment of seismic hazards
  - Recommendations for foundation support, including allowable bearing capacity, estimated foundation settlement, and lateral resistance parameters for shallow foundations
  - Recommendations for floor slab subgrade preparation
  - Recommendations for retaining walls, including lateral earth pressures, backfill, compaction, and drainage
  - Recommendations for site preparation, including grading and drainage, stripping depths, fill type for imported material, compaction criteria, trench excavation and backfill, use of on-site soil, and wet/dry weather earthwork
  - Recommendations for bedrock excavation
  - Recommendations for managing identified groundwater conditions that may affect the performance of structures and site improvements
  - Recommendations for AC pavement design for on-site access drives and parking areas, including subbase, base course, and AC paving thicknesses
  - Code-based seismic design parameters in accordance with the 2022 SOSSC

5.0 SITE CONDITIONS

5.1 GEOLOGY

The site is located on an upland terrace extending southeast from the Tualatin Mountains. The Tualatin Mountains form the physiographic boundary between the Portland Basin to the north and east, the Tualatin Basin to the west, and the Central Willamette Valley to the south. These basins are part of the larger Puget Sound-Willamette Valley physiographic province, a tectonically active lowland situated between the Coast Range to the west and the Cascade Mountains to the east (Orr and Orr 1999).

Geologic mapping by Schlicker and Finlayson (1979) and Madin (2009) indicates that near-surface geology consists of Miocene-aged (16 million to 12 million years old) basalt flows of the CRBG. The CRBG is a series of basalt flows that originated from southeastern Washington and northeastern Oregon.

5.2 SURFACE CONDITIONS

The 11.41-acre site is bounded by Tannler Drive to the east, Blankenship Road to the south, commercial development to the west, and residential development to the north. The site is generally open, vacant, and covered by grasses and brush. Scattered mature trees are present in the north portion of the site and along property boundaries. The site slopes up to the north, with grades ranging from approximately 12 to 17 percent. Site elevations range from approximately 384 feet at the northern site boundary to 200 feet adjacent to Blankenship Road (WGS 84).

5.3 SUBSURFACE CONDITIONS

Subsurface conditions were explored by excavating 10 test pits (TP-1 through TP-10) to depths between 2 and 6 feet BGS. Our subsurface exploration program was supplemented with previous subsurface explorations conducted at the site by GeoDesign (GeoDesign 2006, 2014). GeoDesign's explorations included 33 test pits excavated to depths between 3.3 and 13.5 feet BGS.

The recent exploration locations are shown on Figures 2 and 3. A description of our field exploration program and the exploration logs are presented in Appendix A. A description of the laboratory testing program and the test results are presented in Appendix B. Prior exploration locations, exploration logs, and laboratory test results prepared by GeoDesign are presented in Appendix C. A summary of the subsurface conditions is presented below.

5.3.1 Root Zone and Topsoil

All of our test pits were explored through surface vegetation consisting of 8 to 12 inches of topsoil and a 2- to 5-inch-thick root zone. The topsoil generally consists of silt with gravel and trace organics. Previous explorations by GeoDesign encountered 2- to 8-inch-thick root zones with up to 18 inches of topsoil that contains abundant shrub roots.

5.3.2 Undocumented Fill

Undocumented fill was encountered in test pit TP-11 of GeoDesign's 2006 field investigation and extends to a depth of 4 feet BGS. The fill consists of silt with trace to some gravel and trace clay.

5.3.3 Silt (Colluvium)
Underlying the topsoil in test pits TP-1 through TP-7, and TP-10, medium stiff silt with varying proportions of gravel extends to depths between 1.5 and 5 feet BGS. This unit represents colluvium. The tested moisture content of the silt ranged from 12 to 23 percent at the time of exploration. Atterberg limits testing indicates that the silt exhibits medium plasticity. Previous explorations by GeoDesign encountered the silt to similar depths.

5.3.4 Decomposed Basalt
Underlying the topsoil in test pits TP-8 and TP-9 and the silt layer in test pit TP-6, gravelly silt to silty gravel extends to depths of 3 to 4 feet BGS. The gravelly silt is stiff to very stiff and the silty gravel is medium dense to very dense. This unit represents decomposed residual soil of the underlying basalt bedrock. The silt and gravel constituents vary across the site based on the degree of decomposition. Our excavator was able to penetrate this unit without much difficulty. Previous explorations by GeoDesign also encountered this unit, which was observed to be up to 8 feet thick. The tested moisture content of the unit ranged from 11 to 33 percent at the time of exploration.

5.3.5 Basalt
All of our test pits met refusal on basalt at depths between 2 and 6 feet BGS. The observed depth to refusal in each test pit is shown on Figures 2 and 3. Many of the previous explorations by GeoDesign also met refusal on basalt at depths between 3.3 and 13.5 feet BGS. The upper portion of the bedrock is generally decomposed to weathered and fractured. Weathering appears to generally decrease with depth. The excavator was able to penetrate the weathered zones of basalt but was unable to penetrate the intact basalt, even with significant effort. Our scope of services did not include exploration of the intact basalt using rock coring techniques. Accordingly, we are unable to assess the degree of weathering and fracturing of the intact basalt. The upper rock layers exposed in the test pits are generally moderately to intensely fractured and very close to close jointed. Based on our experience and prior observations of deep rock coring in the site vicinity, we believe that the upper portion of the intact bedrock is likely highly to slightly weathered and very intensely to moderately fractured.

5.3.6 Groundwater
Groundwater was not observed in our current explorations. Slow to moderate groundwater seepage was reported in three of the previous test pits at depths between 3.5 and 10 feet BGS. According to Snyder (2008), the approximate elevation of the static groundwater table at the site is 175 feet. This elevation corresponds to an approximate depth to groundwater of 25 to 210 feet BGS depending on location and ground surface elevation. Groundwater levels are also subject to seasonal variation and may rise during extended periods of increased precipitation or flooding. During and after periods of rainfall, groundwater will likely become perched on the shallow bedrock formation and travel downslope where it could manifest at the ground surface or in walls where the top of bedrock is exposed by cuts or below-grade structures.

5.4 SEISMIC HAZARDS
5.4.1 Liquefaction
Liquefaction is a phenomenon caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles. Granular soil, which relies on interparticle friction for

strength, undergoes a loss of strength until the excess pore pressures dissipate. In general, loose, saturated sand soil with low silt and clay content is the most susceptible to liquefaction. Low plasticity, silty sand and silt may be moderately susceptible to liquefaction under relatively higher levels of ground shaking. Based on our explorations and the observed shallow depth to bedrock, liquefaction is not considered a hazard at the site.

5.4.2 Lateral Spreading

Lateral spreading is a liquefaction-related seismic hazard and occurs on gently sloping or flat sites underlain by liquefiable sediment adjacent to an open face, such as a riverbank. Liquefied soil adjacent to an open face can flow toward the open face, resulting in lateral ground displacement. Since liquefaction is not a hazard at the site, lateral spreading is not a geotechnical design consideration for the project.

5.4.3 Fault Rupture

Based on USGS interactive fault mapping, the nearest mapped fault to the site is the Canby-Molalla fault, which is located approximately 3 km southwest of the site (USGS 2025). As such, fault rupture is not considered a hazard at the site.

6.0 DESIGN

6.1 FOUNDATION SUPPORT

6.1.1 General

The proposed structures can be supported by spread footings bearing on firm, native soil and rock or engineered structural fill overlying undisturbed native material. For structures near slopes, we recommend foundations have sufficient embedment to provide a minimum 10-foot offset from the free face of the slopes. For existing slopes steeper than 2H:1V or foundations located behind retaining walls, we recommend that foundations or foundation-supporting elements be embedded such that they are set back at least 5 feet from a 2H:1V grade projected from the base of the slope or wall as shown on Figure 4. The minimum footing offsets and embedments indicated above may be ignored for foundations bearing on basalt bedrock.

Foundations should not be supported by undocumented fill, soft soil, or disturbed soil. If encountered, these materials should be improved or completely removed and replaced with structural fill. If footing subgrade soil is above its optimum moisture content at the time of subgrade preparation, we recommend that a minimum of 4 inches of compacted aggregate be placed over exposed subgrade soil to protect it from foot traffic. The aggregate should consist of imported granular material as described in Section 7.4.1 (Structural Fill). Columbia West should observe exposed subgrade prior to placement of crushed aggregate to confirm that the foundation subgrade is prepared in accordance with the recommendations in this report.

6.1.2 Bearing Capacity

Continuous wall and isolated spread footings should be at least 18 inches and 24 inches wide, respectively. The bottoms of exterior footings should be at least 18 inches below the lowest adjacent exterior grade. The bottoms of interior footings should be established at least 12 inches below the base of the slab.

Footings bearing on native silt or silty gravel/gravelly silt subgrade prepared as recommended above should be sized based on an allowable bearing pressure of 2,500 psf. The bearing pressure can be increased to 3,000 psf for footings established on gravel pads and 8,000 psf for footings established on bedrock. These are net bearing pressures; the weight of the footing and overlying backfill can be ignored in calculating footing sizes. The recommended allowable bearing pressures apply to the total of dead plus long-term live loads and may be increased by one-third for short-term loads such as those resulting from wind or seismic forces.

6.1.3 Settlement

There is potential for differential settlement between adjacent columns where one is founded directly on bedrock and the other on native silty soil. Based on the expected column loads, our analyses indicate that columns founded directly on native silt or silty gravel could experience settlement magnitudes up to approximately 0.75 inch, while settlement of columns on bedrock will be negligible. Therefore, the total differential settlement will be up to 0.75 inch.

If this level of differential settlement in not acceptable, we recommend that all foundations be established on either bedrock or 1-foot-thick compacted gravel pads overlying native soil. We estimate that the total settlement for footings established on gravel pads will be less than 0.5 inch; differential settlement between adjacent columns on gravel pads and bedrock will also be less than 0.5 inch. Footing pads should extend at least 6 inches beyond the edges of the footing and consist of imported granular material as described in Section 7.4.1 (Structural Fill). The on-site basalt can be used if it is processed to meet the requirements of imported granular material.

6.1.4 Resistance to Sliding

Lateral loads on footings can be resisted by passive earth pressure on the sides of the structures and by friction on the bases of the footings. Our analysis indicates that the available passive earth pressure for footings confined by on-site silt and gravelly soil or structural fill is 350 pcf, modeled as an equivalent fluid pressure. The recommended passive pressure can be increased to 800 pcf for footings confined entirely by intact basalt bedrock. Adjacent floor slabs, pavement, or the upper 12-inch depth of unpaved areas should not be considered when calculating passive resistance. In addition, in order to rely on passive resistance, a minimum of 10 feet of horizontal clearance must exist between the faces of the footings and any adjacent downslopes.

For footings in contact with the on-site native silt, a coefficient of friction equal to 0.30 may be used when calculating resistance to sliding. This value may be increased to 0.40 for footings in contact with basalt bedrock, silty gravel, or compacted gravel pads.

6.1.5 Subgrade Observation and Preparation

All footing subgrade should be evaluated by a representative of Columbia West to confirm suitable bearing conditions. Observations should also confirm that loose or soft material, organic material, unsuitable fill, prior topsoil zones, and softened subgrade have been removed. Localized deepening of footing excavations may be required to penetrate any deleterious or soft material, particularly during wet weather conditions. Footing excavations should be backfilled with compacted crushed aggregate.

Excavations that extend into the underlying basalt may require special excavation considerations as discussed in Section 7.3 (Excavation).

6.2 FLOOR SLABS

Floor slabs can be supported on firm, competent, native soil or engineered structural fill prepared as described in this report. Floor slabs with maximum floor loads of 150 psf may be designed assuming a modulus of subgrade reaction, k, of 150 pci.

To provide a capillary break, slabs should be underlain by at least 6 inches of compacted crushed aggregate that contains less than 5 percent fines by dry weight. Geotextile may be used below the crushed aggregate layer to increase subgrade support. Recommendations for floor slab aggregate base and subgrade geotextile are discussed in Section 7.4 (Materials).

We anticipate that floor slabs may be founded partially on bedrock and partially on soil. There is a potential for differential settlement or reflection cracking of floor slabs along bedrock/soil transitions. We recommend that the floor slab base section be increased to a minimum of 12 inches along such transitions to reduce the potential for excessive differential settlement. The thickened section should extend laterally at least 15 feet on either side of the interface. Since the exact location of the soil/rock interface is impossible to predict, sufficient field observation will be necessary during slab preparation to identify these conditions.

The on-site soil will tend to maintain a moderate to high moisture content. The installation of a vapor barrier may be warranted in order to reduce the potential for moisture transmission through and efflorescence growth on the floor slabs. In addition, flooring manufacturers often require vapor barriers to protect flooring and flooring adhesives and will warrant their product only if a vapor barrier is installed according to their recommendations. Actual selection and design of an appropriate vapor barrier, if needed, should be based on discussions among members of the design team.

All slab subgrade should be evaluated by a member of our geotechnical staff to confirm suitable bearing conditions. Observations should also confirm that loose or soft material, organic material, unsuitable fill, prior topsoil zones, and softened subgrade have been removed and replaced with structural fill. In addition, contaminated base rock for the slabs should be removed and replaced prior to pouring the slab.

6.3 SEISMIC DESIGN CRITERIA

Seismic design for the proposed structures is prescribed by the 2022 SOSSC, which references ASCE 7-16. Based on the results of our subsurface explorations, the site soil and rock conditions meet the criteria for Site Class B. Seismic design parameters for Site Class B are presented in Table 1.

Table 1. Seismic Design Parameters in Accordance with ASCE 7-16

Parameter	Short Period (T_s)	1-Second Period (T_1)
MCE spectral response acceleration, S	S_s = 0.837 g	S_1 = 0.378 g
Site class	B	
Site coefficient, F	F_a = 0.9	F_v = 0.8
Adjusted spectral response acceleration, S_M	S_{MS} = 0.75 g	S_{M1} = 0.30 g
Design spectral response acceleration, S_D	S_{DS} = 0.50 g	S_{D1} = 0.20 g

6.4 *RETAINING STRUCTURES*

6.4.1 Assumptions

Our retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls, (2) the walls are less than 8 feet in height, (3) the backfill is drained, and (4) the backfill has a slope flatter than 4H:1V. We recommend that a qualified geotechnical engineer perform design calculations for the larger on-site walls once the wall type and geometry has been determined.

The following design parameters may be applicable for larger walls that may be proposed. However, if design is performed by others, Columbia West should review preliminary wall plans to determine if the design parameters are suitable and should review the final wall calculations.

Retaining walls may not be necessary where intact bedrock is encountered. However, we recommend additional exploration via rock coring to evaluate the presence of bedding planes; assess the feasibility of constructing large, over-steepened cuts into the rock; and assess the potential need for retaining walls. Based on the current conceptual plan, we anticipate that at least three borings with rock coring to depths between approximately 25 and 35 feet BGS will be required.

We expect that walls can be constructed directly on top of the intact bedrock. In this case, the project team should consider installing fascia over the entire wall to create a uniform appearance.

6.4.2 Wall Design Parameters

Unrestrained site walls that retain native soil and decomposed bedrock should be designed to resist active earth pressures of 35 to 55 pcf when supporting slopes between 4H:1V and 2H:1V, respectively. These values can be reduced to 25 to 30 pcf for wall supporting moderately weathered bedrock at the same slope angles. Where retained slopes are between inclinations of 4H:1V and 2H:1V, the designer may linearly interpolate between these active earth pressures. For embedded building walls, seismic lateral forces can be modeled assuming a force of $6H^2$ pounds per lineal foot of wall, where H is the height of the wall in feet, and applied as a distributed load with centroid located at 0.6H from the base of the wall, where H is the height of the wall.

If retaining walls are restrained from rotation prior to being backfilled, the aforementioned active earth pressures should be increased by 15 pcf. If other surcharges (e.g., slopes steeper than 2H:1V, foundations, vehicles, etc.) are located within a horizontal distance from the back of a wall equal to twice the height of the wall, additional pressures should be accounted for in the wall design. Lateral earth pressures induced by surcharge loads may be estimated using the criteria presented on Figure 5.

The wall footings should be designed in accordance with the guidelines in Section 6.1 (Foundation Support).

6.4.3 Wall Drainage and Backfill

The above design parameters have been provided assuming drains will be installed behind the wall to prevent buildup of hydrostatic pressures behind all walls. If a drainage system is not installed, our office should be contacted for revised design forces.

Backfill placed behind the walls and extending a horizontal distance of ½H, where H is the height of the retaining wall, should consist of retaining wall select backfill placed and compacted in conformance with Section 7.4.1 (Structural Fill).

A minimum 6-inch-diameter, perforated collector pipe should be placed at the bases of the walls. The pipe should be embedded in a minimum 2-foot-wide zone of angular drain rock that is wrapped in a drainage geotextile fabric and extends up the back of the walls to within 1 foot of the finish grade. The drain rock and drainage geotextile fabric should meet the specifications in Section 7.4 (Materials). The perforated collector pipes should discharge at an appropriate location away from the bases of the walls. The discharge pipes should not be tied directly into stormwater drain systems, unless measures are taken to prevent backflow into the drainage systems of the walls.

Settlement of up to 1 percent of the wall height commonly occurs immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend construction of flatwork adjacent to retaining walls be postponed at least four weeks after backfilling of the walls, unless survey data indicates that settlement is complete prior to that time.

6.5 PAVEMENT

We understand that private AC pavement may be proposed for on-site access drives and vehicle parking. Pavement should be installed on compacted subgrade or new engineered fill prepared in conformance with Section 7.1 (Site Preparation). Pavement improvements in the public right-of-way should adhere to jurisdictional guidelines.

6.5.1 Design Values

At the time this report was prepared, the volume of traffic for the development was unknown. Consequently, we have provided pavement sections for automobile-only parking, automobile-only drive aisles, and drive aisles that will also service heavy vehicle traffic (i.e., garbage trucks, semitrucks, etc.). Our pavement recommendations are based on the following design parameters and assumptions:

- Resilient moduli for subgrade soil and aggregate base material were assumed to be 4,000 psi and 20,000 psi, respectively.
- Pavement design life of 20 years with no expected traffic growth.

- Initial and terminal serviceability indices of 4.2 and 2.5, respectively.
- Reliability of 85 percent and standard deviation of 0.4.
- Pavement may be exposed to a fire apparatus load of 75,000 pounds on an infrequent basis.

6.5.2 AC Pavement Sections

Recommended AC pavement sections are presented in Table 2. Material properties and compaction recommendations for AC and aggregate base layers are presented in Section 7.4 (Materials).

Table 2. AC Pavement Sections

Pavement Use	Trucks per Day	AC[1] (inches)	Aggregate Base[1] (inches)
Automobile parking	0	2.5	8
Automobile-only drive aisles	0	3	9
Heavy truck areas	Up to 10	4	10.5
	Up to 25	4.5	12.5
	Up to 50	5	14

1. All thicknesses are intended to be the minimum acceptable.

The material thicknesses in Table 2 are intended to be minimum acceptable values for the final condition. The aggregate base thicknesses do not account for construction traffic, and haul roads and staging areas should be used as described in Section 7.2 (Construction Traffic and Staging).

6.6 *DRAINAGE*

6.6.1 Temporary

During work at the site, the contractor should be made responsible for temporary drainage of surface water as necessary to prevent standing water and/or erosion at the working surface. During rough and finished grading of the site, the contractor should keep all pads and subgrade free of ponding water.

6.6.2 Surface

The ground surface at finished pads should be sloped away from their edges at a minimum 2 percent gradient for a distance of at least 5 feet. Roof drainage from buildings should be directed into solid, smooth-walled drainage pipes that carry the collected water to the storm drain system.

6.6.3 Curtain Drains and Foundation Drains

It is likely that groundwater will become perched on the basalt bedrock layer during periods of persistent rainfall. Groundwater flow could impact downslope buried structures or could daylight in site cuts. Adequate drainage is essential behind retaining walls to serve as a curtain drain to intercept perched groundwater and convey it away from the planned structures. The drain should be sloped to a suitable discharge point. The following section provides recommendations for retaining wall drains are presented in Section 6.4.3 (Wall Drainage and Backfill).

If upslope footing excavations extend into the weathered and intact bedrock, perimeter footing drains should be installed to convey the perched water away from the structures. The footing drains should be constructed at a minimum slope of approximately 0.5 percent and pumped or drained by gravity to a suitable discharge point. The drains should consist of 4-inch-diameter, perforated drainpipe embedded in a minimum 1-foot-wide zone of crushed drain rock, should extend to near the ground surface, and should be wrapped in geotextile fabric. The invert elevation of the drainpipe should be installed at the base of the footing. The drain rock and drainage geotextile should meet the requirements specified in Section 7.4 (Materials).

6.7 PERMANENT SLOPES

Permanent cut and fill slopes in the on-site soil and decomposed bedrock may be constructed up to 15 feet tall to a gradient as steep as 2H:1V. However, cut slopes over 15 feet tall should be limited to a gradient of 2.5H:1V or should be partially retained by a retaining wall. Slopes in moderately weathered basalt bedrock may be constructed to 1H:4V, provided they are observed by a registered geologist or geotechnical engineer. Slopes that will be maintained by mowing should not be constructed steeper than 3H:1V.

Rock slopes should be evaluated to determine if bedding planes exist, which would require flatter cuts or permanent support. Our scope of services did not include exploration of the intact basalt using rock coring techniques. For proposed walls exceeding 15 feet in height, we recommend additional exploration via rock coring to evaluate the presence of bedding planes; assess the feasibility of constructing large, over-steepened cuts into the rock; and assess the potential need for retaining walls. We should also be contacted to review final site grading plans as they are developed to provide appropriate recommendations for additional exploration and analysis.

Newly constructed fill slopes should be overconstructed by at least 12 inches and then trimmed back to the required slope to maintain a firm face. Access roads and pavement should be located at least 5 feet from the top of cut and fill slopes. The setback should be increased to 10 feet for buildings, unless special foundation considerations are implemented. As discussed in Section 6.1 (Foundation Support), for existing slopes steeper than 2H:1V or foundations located behind retaining walls, we recommend that foundations or foundation-supporting elements be embedded such that they are set back at least 5 feet from a 2H:1V grade projected from the base of the slope or wall as shown on Figure 4. Soil slopes should be planted with appropriate vegetation to provide protection against erosion as soon as possible after grading. Surface water runoff should be collected and directed away from slopes to prevent water from running down the face of the slope.

6.7.1 Slope Stability

Our field explorations indicate that subsurface conditions consist of a relatively thin layer of silt overlying decomposed to intact basalt bedrock. The natural slope of the ground surface is approximately 4H:1V or flatter. Published geologic hazard data indicate that the site is not mapped within an area of landslide topography, slump, debris flow, or other seismic hazards

(Schlicker and Finlayson 1979). The nearest ancient landslide feature is mapped more than 0.5 mile east of the site, which resulted from the excavation of the nearby interstate at the toe of the landslide.

Preliminary spot-grading plans indicate that on-site material will generally be cut and filled in a terraced topography, which will likely improve global slope stability. Based on the preliminary spot-grading plan and the quality of the underlying bedrock, it is our opinion that there is a low risk of landsliding at the site. However, as discussed above, large cuts into bedrock may expose bedding planes that could not be observed within our test pit explorations. The presence of bedding planes could impact local stability of proposed cuts and should be evaluated via supplemental borings with rock coring as discussed in prior sections prior to finalizing project grading plans.

7.0 CONSTRUCTION

7.1 SITE PREPARATION

7.1.1 Stripping and Grubbing

The existing root zone should be stripped and removed from all proposed structural fill, pavement, and building areas and for a 5-foot margin around such areas. Based on the current and previous explorations, the depth of removal will generally range from approximately 2 to 8 inches. Thick root masses were also observed in some isolated areas to depths of 12 to 18 inches. The actual stripping depth should be based on field observations at the time of construction. Stripped material should be transported offsite for disposal or used in landscaped areas.

Existing trees or shrubs should be removed from pavement and building areas. In addition, root balls should be grubbed out to the depth of the roots. Depending on the methods used to remove the root balls, considerable disturbance and loosening of the subgrade could occur during site grubbing. We recommend that soil disturbed during grubbing operations be removed to expose firm, undisturbed subgrade. The resulting excavations should be backfilled with structural fill.

7.1.2 Subgrade Evaluation

Upon completion of stripping and prior to the placement of structural fill, exposed subgrade soil should be evaluated by proof rolling with a fully loaded dump truck or similar heavy, rubber-tired construction equipment. When the subgrade is too wet for proof rolling or inaccessible to a loaded dump truck, a foundation probe may be used to identify areas of soft, loose, or unsuitable soil. Subgrade evaluation should be performed by Columbia West. If soft or yielding subgrade areas are identified during evaluation, we recommend the subgrade be over excavated and backfilled with compacted imported granular fill.

7.2 CONSTRUCTION TRAFFIC AND STAGING

Near-surface, fine-grained soil will be easily disturbed during construction. If not carefully executed, site preparation, excavation, and grading can create extensive soft areas, resulting in significant repair costs. Earthwork planning should include considerations for minimizing subgrade disturbance, particularly during wet weather conditions.

If construction occurs during wet weather conditions or if the moisture content of the surficial soil is more than a few percentage points above optimum, site stripping and cutting may need to be accomplished using track-mounted equipment. Under these conditions, granular access pads and staging areas will also be necessary provide a firm support base and sustain construction equipment.

Based on our experience, between 12 and 18 inches of imported granular material is generally required in staging areas and between 18 and 24 inches in areas supporting construction traffic. In areas of heavy construction traffic, geotextile separation fabric may be placed between the subgrade soil and imported granular material to increase subgrade support and minimize fines migration into the aggregate base layer.

As an alternative to thickened crushed rock sections, haul roads and utility work zones may be constructed using cement-amended subgrade overlain by a crushed rock wearing surface. If this approach is used, the thickness of granular material in staging areas and along haul roads can typically be reduced to between 6 and 9 inches. This recommendation is based on an assumed minimum unconfined compressive strength of 100 psi for subgrade amended to a depth of 12 to 16 inches. The actual thickness of the amended material and imported granular material will depend on the contractor's means and methods and, accordingly, should be the contractor's responsibility.

Project stakeholders should understand that wet weather construction is risky and costly. Proper construction methods and techniques are critical to overall project integrity and should be observed and documented by Columbia West.

7.3 EXCAVATION

7.3.1 Basalt Bedrock

The upper portions of the basalt bedrock are weathered and fractured and could generally be penetrated to varying degrees by an excavator. While excavation of weathered bedrock is expected to be more difficult than the silt, we do not expect special excavation equipment to be necessary in the moderately weathered to decomposed material. Excavators used for the current and previous explorations could not penetrate the intact bedrock. Special excavation techniques such as hydraulic breakers, rock trenchers, or blasting will likely be required to excavate the intact basalt bedrock where test pits encountered refusal. The observed depth to refusal on basalt for the current explorations are shown on Figures 2 and 3. The depth to weathered and intact bedrock encountered in the previous explorations are shown on the 2006 Figure 2 and 2014 Figure 2 presented in Appendix C.

The contract bid documents should require that contractors list a unit cost for rock excavation using in-place (bank) volumes, which can be measured by surveying. The unit cost should not be provided in excavated (swelled) volumes, which are more difficult to accurately measure.

7.3.2 Rockfall Hazards

Grading and excavation should be conducted by the earthwork contractor in a sequence that will prevent overhanging rock material that might become dislodged. The contractor should also be responsible for providing protection for property and personnel. This might include sloping of cut areas, building protective berms, or providing catchment netting or equipment at the base of a slope excavation, depending on the final grading plan and construction sequence.

7.3.3 Trench Cuts and Shoring

Trench cuts in the silt and gravelly soil should stand near vertical to a depth 4 feet, with moderate potential for raveling. Open excavation techniques may be used to excavate trenches with depths between 4 and 8 feet, provided the walls of the excavation are cut at a slope of 1H:1V, groundwater seepage is not present, and with the understanding that some raveling may occur. The trenches should be flattened to a stable inclination if excessive raveling or caving occurs. Trenches in the bedrock should stand near vertical and should not require shoring. Some minor raveling should be expected in closely fractured zones of the basalt.

Use of a trench shield or other approved temporary shoring is recommended in the silt and gravelly soil where sloping is not possible. If a conventional shield is used, the contractor should limit the length of open trench. If shoring is used, we recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation. All excavations should be made in accordance with applicable OSHA and state regulations.

7.3.4 Temporary Dewatering

Perched groundwater will likely be encountered in excavations during and following periods of persistent rainfall. Groundwater flowing into open excavations should be removed by pumping from a sump. The pump should be capable of handling variable flow rates. Water should be routed to a suitable discharge point.

7.3.5 Open Excavations

Open excavations will be necessary for building cuts. Cuts up to 15 feet in slightly weathered to intact bedrock will likely stand vertical and may not require shoring or sloping. However, rock scaling may be required to mitigate rockfall hazards. Cuts exceeding 15 feet into bedrock may require flatter inclinations, unless additional exploration and evaluation indicate that vertical cuts are feasible. We recommend that cuts in the overlying silt, gravelly soil, and highly weathered basalt be sloped in accordance with OSHA regulations. Temporary shoring may be possible to support cuts in soil, but may be difficult to install due to the underlying bedrock. If shoring is used, we recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation.

7.4 MATERIALS

7.4.1 Structural Fill

7.4.1.1 General

Areas proposed for fill placement should be appropriately prepared as described in Section 7.1 (Site Preparation). Engineered fill placement should be observed by Columbia West. Compaction of engineered structural fill should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. Field compaction testing should be performed for each vertical foot of engineered fill placed.

Various materials may be acceptable for use as structural fill. Structural fill should be free of organic material or other unsuitable material and meet the specifications provided in the following sections. Representative samples of proposed engineered structural fill should be submitted for laboratory testing and approval by Columbia West prior to placement.

7.4.1.2 On-Site Soil

The on-site native soil is generally suitable for use as structural fill, provided it is free of debris, organic material, or other unsuitable material and has no particles larger than 6 inches in diameter. Gravelly or chipped bedrock material may need to be crushed or processed to achieve smaller particle sizes before placing as fill.

On-site silty soil will be difficult, if not impossible, to adequately compact at all times of the year, except the dry summer months. We expect that moisture conditioning (drying) will be required to use on-site silty soil for structural fill. Accordingly, extended dry weather will be required to adequately condition the soil for use as structural fill.

The native gravel soil contains varying amounts of silt. As silt content increases, sensitivity to moisture also increases. It should not be assumed that the silty gravel will be able to be adequately compacted during wet weather.

The weathered and intact bedrock will have to be crushed and processed into a smaller, well-graded distribution prior to placement as structural fill. When placed as embankment fill, the material should have no particles larger than 6 inches in diameter. Occasional cobbles up to 10 inches in diameter may be acceptable in the on-site soil, provided they are dispersed in the fill, they do not create voids in the fill matrix, and compaction can be achieved by sufficiently large equipment. Compaction equipment should impart enough energy to break cobbles. Fill containing oversized material should be closely monitored by qualified geotechnical field staff. Fine grading of gravelly soil may result in segregating cobbles or coarse gravel from the sandy/fine gravel matrix, resulting in unsatisfactory (poorly graded or "boney") fill. Fill material should be maintained as well graded with gravelly and sandy material for proper compaction during fill placement and mass grading.

If the native basalt will be processed and used as aggregate base or trench backfill, it should meet the requirements listed further in this section. When used as structural fill, on-site soil should be placed in lifts with a maximum uncompacted thickness of 8 inches and compacted to not less than 95 percent of maximum dry density as determined by ASTM D1557.

7.4.1.3 Imported Granular Material

Imported granular material should consist of pit- or quarry-run rock, crushed rock, or crushed gravel and sand. The imported granular material should also be durable, angular, and fairly well graded between coarse and fine material; should have less than 5 percent fines by dry weight; and should have at least two mechanically fractured faces. Imported granular material should be placed in loose lifts not exceeding 12 inches in thickness and compacted to at least 95 percent of maximum dry density as determined by ASTM D1557. During wet weather conditions or where wet subgrade conditions are present, the initial loose lift of granular fill should be approximately 18 inches thick and should be compacted with a smooth-drum roller operating in static mode.

7.4.1.4 Trench Backfill

Trench backfill placed below, adjacent to, and up to at least 12 inches above utility lines (i.e., the pipe zone) should consist of well-graded granular material with a maximum particle size of 1½ inches and less than 7 percent fines by dry weight. Material should meet the specifications of OSSC 00405.13 (Pipe Zone Material). Pipe zone backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer.

Within pavement areas, the remainder of the trench backfill up to subgrade elevation should consist of well-graded granular material with a maximum particle size of 2½ inches and less than 7 percent fines by dry weight. The material should meet the specifications of OSSC 00405.14 (Trench Backfill; Class B, C, or D). This material should be compacted to at least 92 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer. The upper 3 feet of the trench backfill should be compacted to at least 95 percent of modified maximum dry density.

Outside of structural areas, trench backfill placed above the pipe zone may consist of general fill material that has a maximum particle size of 6 inches, is free of organic material, and meets the specifications of OSSC 00405.14 (Trench Backfill; Class A, B, C, or D). This general trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer.

7.4.1.5 Stabilization Material

Stabilization material should consist of pit- or quarry-run rock, crushed rock, or crushed gravel meeting the specifications of OSSC 00330.16 (Stone Embankment Material). The material should have at least two fractured faces, a maximum particle size of 6 inches, and less than 5 percent by dry weight passing the U.S. Standard No. 4 sieve. Stabilization material should be free or organic material or other unsuitable material.

Stabilization material should be placed in loose lifts between 12 and 18 inches thick and compacted to a firm, unyielding condition with a smooth-drum roller operating without vibratory action. If stabilization material is used to stabilize soft subgrade beneath pavement or construction haul roads, a geotextile should be placed as a separation barrier between the soil subgrade and the stabilization material. Geotextile is not required where stabilization material is used to stabilize the bases of utility trenches. Placement of stabilization material should conform to the specifications of OSSC 00331 (Subgrade Stabilization).

7.4.1.6 Drain Rock

Drain rock should consist of angular, granular material with a maximum particle size of 2 inches and less than 2 percent fines by dry weight. Drain rock should be free of roots, organic material, and other unsuitable material and should have at least two mechanically fractured faces. Drain rock should be compacted to a firm, unyielding condition. Drain rock should be completely wrapped in a geotextile drainage fabric meeting the requirements presented below.

7.4.1.7 Retaining Wall Backfill
Backfill material placed behind retaining walls and extending a horizontal distance of ½H, where H is the height of the retaining wall, should consist of imported granular material as described above and should have less than 7 percent fines by dry weight. We recommend the wall backfill be separated from general fill, native soil, and/or topsoil using a geotextile fabric that meets the specifications provided below for drainage geotextiles.

The wall backfill should be compacted to a minimum of 95 percent of maximum dry density as determined by ASTM D1557. However, backfill located within a horizontal distance of 3 feet from a retaining wall should only be compacted to approximately 90 percent of maximum dry density as determined by ASTM D1557. Backfill placed within 3 feet of the wall should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (such as a jumping jack or vibratory plate compactor). If flatwork (sidewalks or pavement) will be placed atop the wall backfill, we recommend that the upper 2 feet of material be compacted to 95 percent of maximum dry density as determined by ASTM D1557.

7.4.1.8 Retaining Wall Leveling Pad
Imported granular material placed at the bases of retaining wall footings should consist of select granular material. The granular material should be ¾- to 1-inch-minus aggregate size and should have at least two mechanically fractured faces. The leveling pad material should be placed in a 6- to 12-inch-thick lift and compacted to not less than 95 percent of maximum dry density as determined by ASTM D1557.

7.4.1.9 Floor Slab Aggregate Base
Aggregate base for building floor slabs should consist of ¾- or 1½-inch-minus (as applicable), imported granular material meeting the requirements of OSSC 00641 (Aggregate Subbase, Base, and Shoulders). Slab aggregate base should have less than 5 percent fines by dry weight. During the dry season, aggregate base may contain up to 10 percent fines by dry weight. Slab aggregate base should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

7.4.2 Pavement
7.4.2.1 AC
The AC should be Level 2, ½-inch, dense ACP according to OSSC 00744 (Asphalt Concrete Pavement) and compacted to 92 percent of the theoretical maximum density of the mix as determined by AASHTO T 209. The minimum and maximum lift thicknesses are 2 inches and 3 inches, respectively, for ½-inch ACP. Asphalt binder should be performance graded and conform to PG 64-22 or better. The binder grade should be adjusted depending on the aggregate gradation and amount of recycled asphalt pavement and/or recycled asphalt shingles in the contractor's mix design submittal.

7.4.2.2 Cold Weather Paving Considerations
In general, AC paving is not recommended during cold weather (temperatures less than 40 degrees Fahrenheit). Compacting under these conditions can result in low compaction and premature pavement distress.

Each AC mix design has a recommended compaction temperature range that is specific for the particular AC binder used. In colder temperatures, it is more difficult to maintain the temperature of the AC mix as it can lose heat while stored in the delivery truck, as it is placed, and in the time between placement and compaction. In Oregon, the AC surface temperature during paving should be at least 40 degrees Fahrenheit for lift thickness greater than 2.5 inches and at least 50 degrees Fahrenheit for lift thickness between 2 and 2.5 inches.

If AC paving activities must take place during cold weather construction as defined above, the contractor and design team should discuss options for minimizing risk of pavement serviceability.

7.4.2.3 Pavement Aggregate Base

Aggregate base for pavement should consist of ¾- or 1½-inch-minus (as applicable) imported granular material meeting the requirements of OSSC 02630.10 (Dense-Graded Aggregate). Pavement aggregate base should have less than 5 percent fines by dry weight. During the dry season, aggregate base may contain up to 10 percent fines by dry weight. Pavement aggregate base should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

7.4.3 Geotextile Fabric

7.4.3.1 Subgrade Geotextile

Subgrade geotextile should conform to OSSC Table 02320-4 and OSSC 00350 (Geosynthetic Installation). A minimum initial aggregate base lift of 6 inches is required over geotextiles. All drainage aggregate and stabilization material should be underlain by a subgrade geotextile.

7.4.3.2 Drainage Geotextile

Drainage geotextile should conform to Type 2 material of OSSC Table 02320-1 and OSSC 00350 (Geosynthetic Installation). A minimum initial aggregate base lift of 6 inches is required over geotextiles.

7.5 EROSION CONTROL

Soil at this site is susceptible to erosion by wind and water; therefore, erosion control measures should be carefully planned and installed before construction begins. Surface water runoff should be collected and directed away from sloped areas to prevent water from running down the slope face. Measures that can be employed to reduce erosion include the use of silt fences, hay bales, buffer zones of natural growth, sedimentation ponds, and granular haul roads. All erosion control methods should be in accordance with local jurisdiction standards.

8.0 OBSERVATION OF CONSTRUCTION

Satisfactory pavement, earthwork, and foundation performance depends to a large degree on the quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Columbia West should be retained to observe subgrade preparation, fill placement, foundation excavations, drainage system installation, and pavement placement and to review laboratory compaction and field moisture-density information.

Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated.

9.0 LIMITATIONS

We have prepared this report for use by the addressee and members of the design and construction team for the proposed project. This report is subject to the limitations expressed in Appendix D.

♦ ♦ ♦

We appreciate the opportunity to be of service to you. Please call if you have questions concerning this report or if we can provide additional services.

Sincerely,

Greg L. Williamson, PE
Senior Geotechnical Engineer

Najib A. Kalas, PE
Principal Engineer

Brett A. Shipton, PE, GE
Principal Engineer

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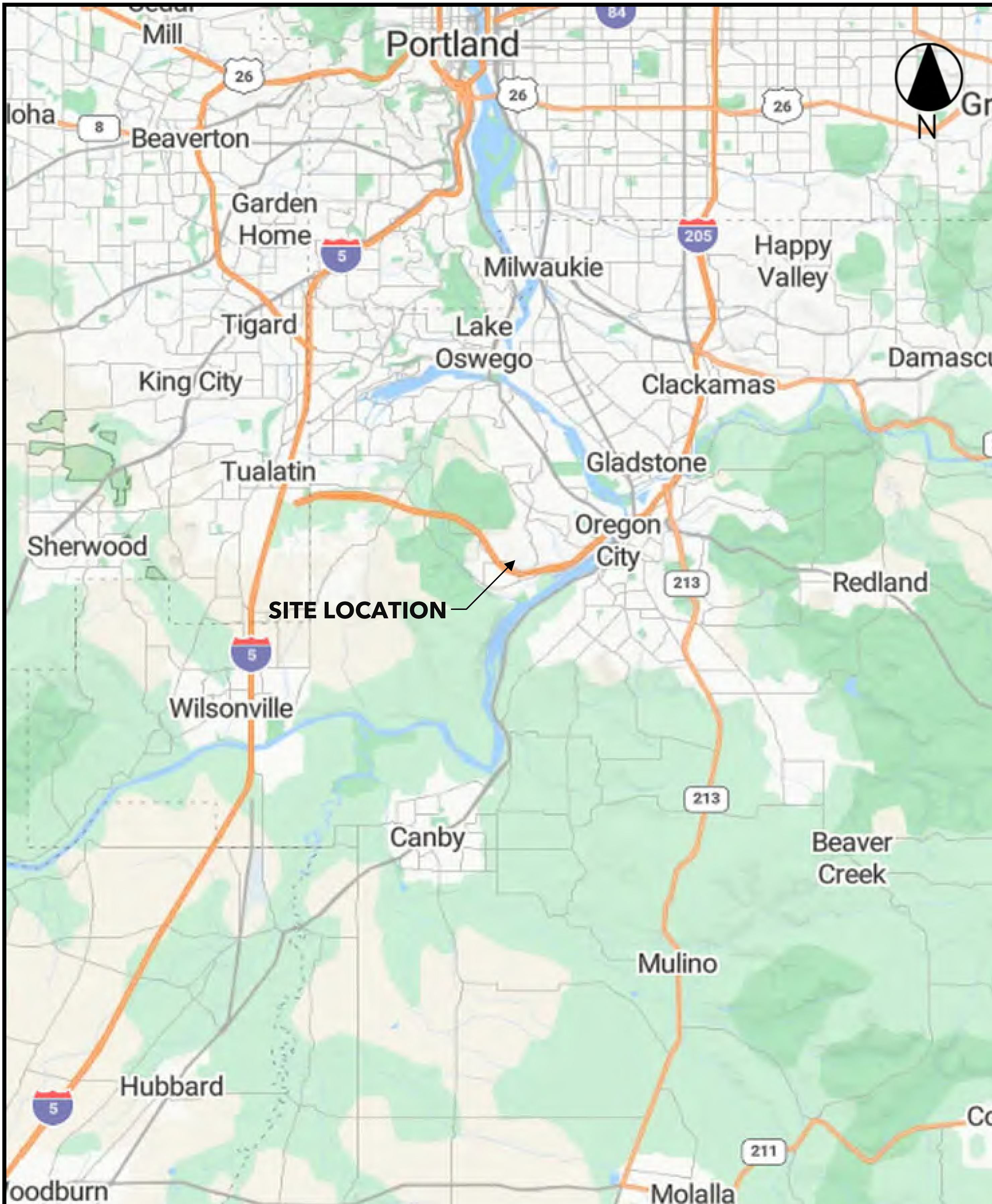
FIGURES



Geotechnical ■ Environmental ■ Special Inspections Columbia West Engineering, Inc	PROJECT NO.: MCRT-1-01-1 SEPTEMBER 2025	VICINITY MAP MODERA WEST LINN WEST LINN, OREGON	FIGURE 1

LEGEND

SITE BOUNDARY

TEST PIT

(6) DEPTH TO REFUSAL ON BASALT (FEET BGS)

N

0 28 56 84 112 140 280

NOTES:
1. AERIAL PHOTO SOURCED FROM GOOGLE EARTH.
2. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
3. REFER TO REPORT TEXT FOR EXPLORATION DESCRIPTIONS.

Columbia West Engineering, Inc
Geotechnical • Environmental • Special Inspections

MODERA WEST LINN
WEST LINN, OREGON
TANNLER DRIVE AND BLANKENSHIP ROAD

SITE PLAN - EXISTING CONDITIONS

PROJECT NO:
MCRT-1-01-1

SEPTEMBER 2025

FIGURE
2

LEGEND

SITE BOUNDARY

TEST PIT

(6) DEPTH TO REFUSAL ON BASALT (FEET BGS)

N

0 25 50 75 100 125 250

NOTES:
1. CONCEPTUAL SITE AND GRADING PLAN PREPARED BY HILL ARCHITECTS, DATED AUGUST 29, 2025.
2. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
3. REFER TO REPORT TEXT FOR EXPLORATION DESCRIPTIONS.

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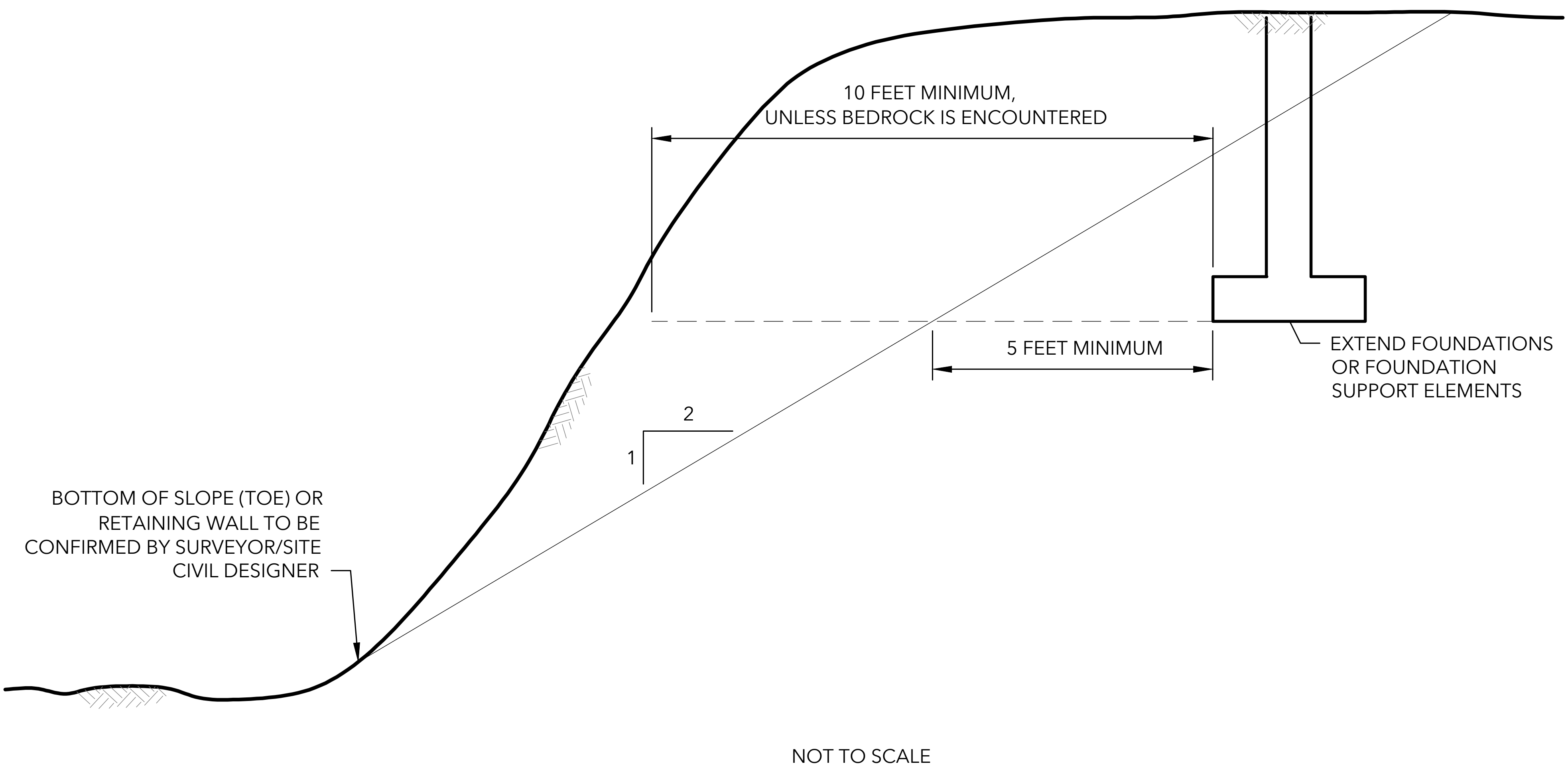
MODERA WEST LINN
WEST LINN, OREGON
TANNLER DRIVE AND BLANKENSHIP ROAD

SITE PLAN - PROPOSED CONDITIONS

PROJECT NO: MCRT-1-01-1

SEPTEMBER 2025

FIGURE
3



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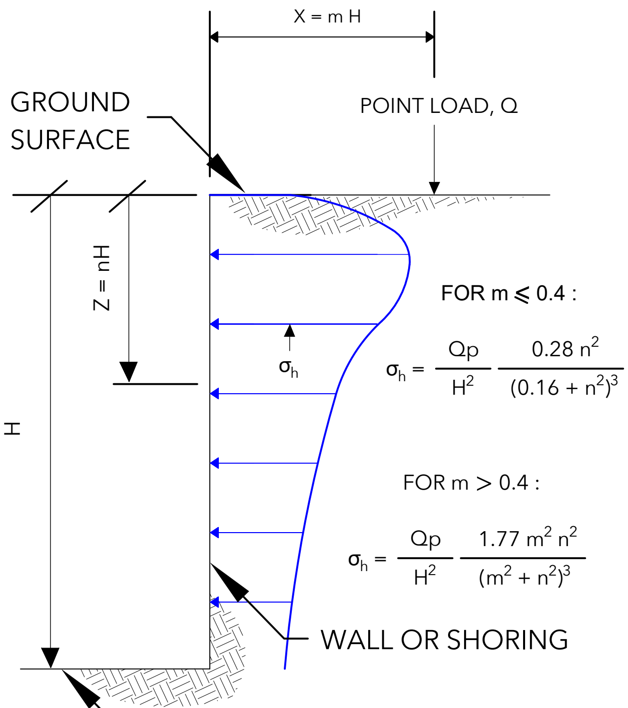
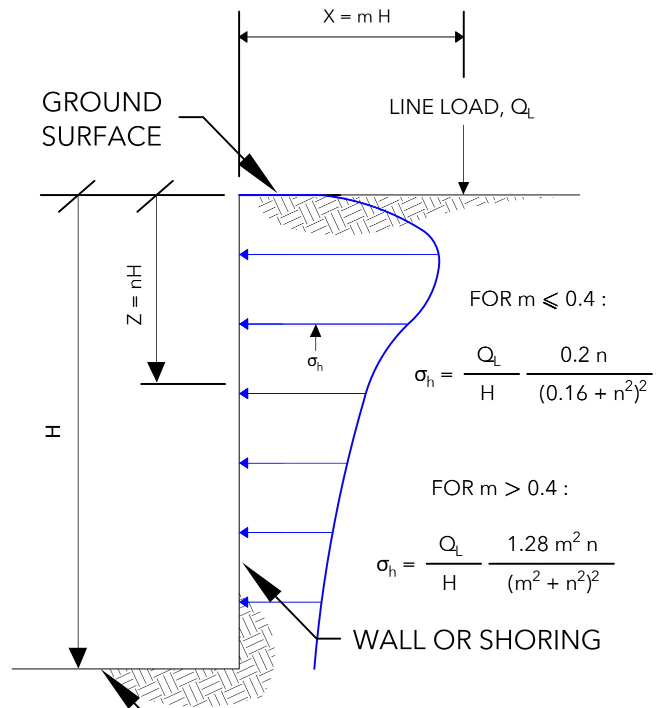
FOUNDATION OFFSET SCHEMATIC

FIGURE 4

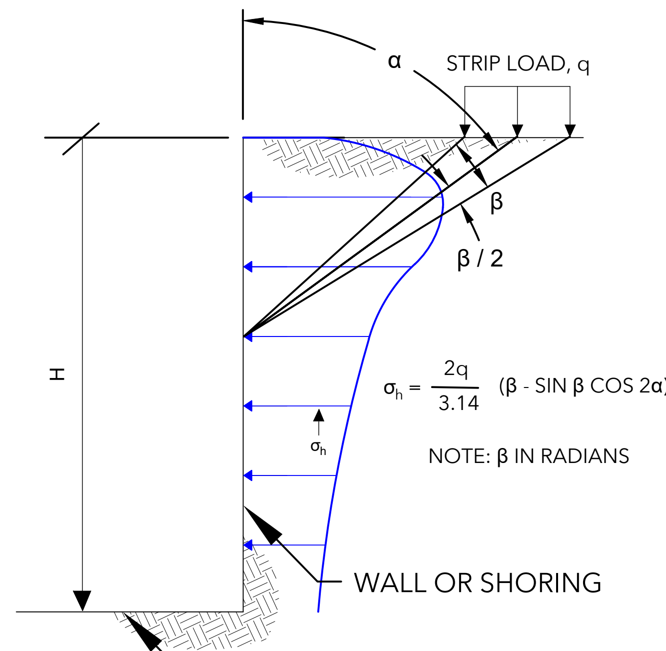
VERTICAL POINT LOAD



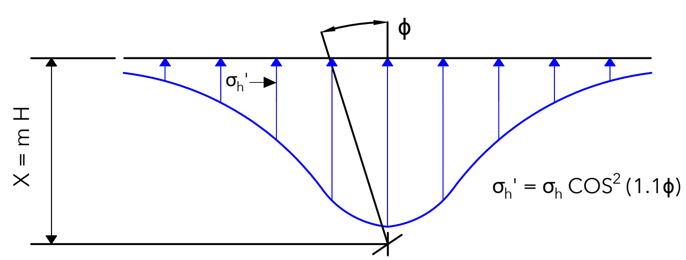
LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL



VERTICAL POINT LOAD
HORIZONTAL PRESSURE DISTRIBUTION



NOTES:
1. FIGURE SHOULD BE USED JOINTLY WITH RECOMMENDATIONS PRESENTED IN THE REPORT TEXT.
2. LATERAL EARTH PRESSURES ASSUME RIGID WALLS WITH BACKFILL MATERIALS HAVING A POISSON'S RATIO OF 0.5.
3. TOTAL LATERAL EARTH PRESSURES RESULTING FROM COMBINED LOADS MAY BE CALCULATED USING SUPERPOSITION.
4. DRAWING IS NOT TO SCALE.

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SURCHARGE-INDUCED LATERAL EARTH PRESSURES

FIGURE
5

APPENDIX A

APPENDIX A
FIELD EXPLORATIONS

GENERAL

We explored subsurface conditions at the site by excavating 10 test pits (TP-1 through TP-10) to depths between 2 and 6 feet BGS. Excavation services were provided by Dan J. Fischer Excavating, Inc. of Forest Grove, Oregon, on August 8, 2025, using a Hitachi ZX40 track-mounted excavator. The explorations were conducted under the supervision of Columbia West personnel. The exploration logs are presented in this appendix.

The approximate exploration locations are shown on Figures 2 and 3. The locations were determined in the field by pacing or measuring from existing site features. This information should be considered accurate only to the degree implied by the methods used.

SOIL AND ROCK SAMPLING

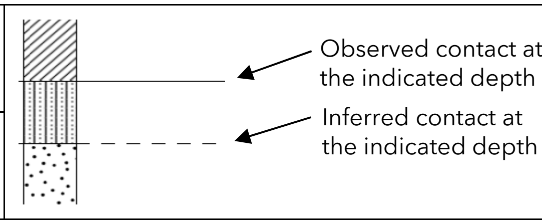
Representative disturbed samples of soil and rock observed in the test pit explorations were collected from the test pit walls and base using the excavator bucket. Sampling methods and intervals are shown on the exploration logs.

SOIL AND ROCK CLASSIFICATION

The soil and rock encountered in the explorations were classified in the field in accordance with the "Exploration Legend," "Soil Classification System," and "Rock Classification System," which are presented in this appendix. The exploration logs indicate the depths at which the soil and rock characteristics change, although the change could be gradual. If the change occurred between sample locations, the depth was interpreted. Classifications are shown on the exploration logs.

EXPLORATION LEGEND

SAMPLER TYPE	DESCRIPTION
SPT	Sample collected from the indicated depth in general accordance with ASTM D1586, *Standard Test Method Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils,* using an SPT sampler and 140-pound hammer
SH	Sample collected from the indicated depth in general accordance with ASTM D1587, *Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes,* using a thin-walled Shelby tube, or in general accordance with ASTM D6519, *Standard Practice for Sampling of Soil Using the Hydraulically Operated Stationary Piston Sampler,* using a thin-walled tube
D&M	Sample collected from the indicated depth in general accordance with ASTM D3550, *Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils,* using a Dames & Moore sampler and 140-pound hammer or pushed
CSS	Sample collected from the indicated depth in general accordance with ASTM D3550, *Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils,* using a 3-inch-outside diameter California split-spoon sampler and 140-pound hammer
DP	Sample collected from the indicated depth in general accordance with ASTM D6282, *Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations,* using a direct-push soil sampler
GRAB	Grab sample collected from the indicated depth
CORE	Pavement or rock core interval at the indicated depth



GEOTECHNICAL ABBREVIATIONS			
ATT	Atterberg limits	PP	Pocket penetrometer
CBR	California bearing ratio	P200	Percent passing No. 200 sieve
CON	Consolidation test	RES	Resilient modulus
DD	Dry density	SIEV	Sieve analysis
DS	Direct shear	TS	Torvane shear
HYD	Hydrometer	tsf	Tons per square foot
MC	Moisture content	UC	Unconfined compressive strength
MD	Moisture-density relationship	UU	Unconsolidated undrained triaxial test
NP	Non-plastic	VS	Vane shear
OC	Organic content	WD	Wet density

ENVIRONMENTAL ABBREVIATIONS			
CA	Sample submitted for chemical analysis	ND	Not detected
		NS	No sheen
PID	Photoionization detector headspace analysis	SS	Slight sheen
		MS	Moderate sheen
ppm	Parts per million	HS	Heavy sheen

SOIL CLASSIFICATION SYSTEM

PARTICLE-SIZE CLASSIFICATION

COMPONENT	ASTM / USCS		AASHTO	
	Size Range	Sieve Size Range	Size Range	Sieve Size Range
Boulders	Greater than 300 mm	Greater than 12 inches	--	--
Cobbles	75 mm to 300 mm	3 inches to 12 inches	Greater than 75 mm	Greater than 3 inches
Gravel	75 mm to 4.75 mm	3 inches to No. 4 sieve	75 mm to 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm to 19.0 mm	3 inches to 3/4-inch sieve	--	--
Fine	19.0 mm to 4.75 mm	3/4-inch to No. 4 sieve	--	--
Sand	4.75 mm to 0.075 mm	No. 4 to No. 200 sieve	2.00 mm to 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm to 2.00 mm	No. 4 to No. 10 sieve	2.00 mm to 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm to 0.425 mm	No. 10 to No. 40 sieve	--	--
Fine	0.425 mm to 0.075 mm	No. 40 to No. 200 sieve	0.425 mm to 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	Less than 0.075 mm	Passing No. 200 sieve	Less than 0.075 mm	Passing No. 200 sieve

CONSISTENCY FOR FINE-GRAINED SOIL

CONSISTENCY	SPT N-VALUE (blows per foot)	D&M N-VALUE (blows per foot)	POCKET PENETROMETER (unconfined compressive strength [tsf])
Very soft	0 to 2	0 to 3	Less than 0.25
Soft	2 to 4	3 to 6	0.25 to 0.5
Medium stiff	4 to 8	6 to 12	0.5 to 1.0
Stiff	8 to 15	12 to 25	1.0 to 2.0
Very stiff	15 to 30	25 to 65	2.0 to 4.0
Hard	Greater than 30	Greater than 30	Greater than 4.0

RELATIVE DENSITY FOR COARSE-GRAINED SOIL

RELATIVE DENSITY	SPT N-VALUE (blows per foot)	D&M N-VALUE (blows per foot)
Very loose	0 to 4	0 to 11
Loose	4 to 10	11 to 26
Medium dense	10 to 30	26 to 74
Dense	30 to 50	74 to 120
Very dense	Greater than 50	Greater than 120

MOISTURE DESIGNATIONS

TERM	FIELD IDENTIFICATION
Dry	Very low moisture, dry to touch
Moist	Damp, color appears darkened, without visible moisture, cohesive soil will clump, sand will bulk
Wet	Visible free water, usually saturated

ADDITIONAL CONSTITUENTS

PERCENT	SILT AND CLAY IN		PERCENT	SAND AND GRAVEL IN		PERCENT	SECONDARY MATERIAL
	Fine-Grained Soil	Coarse-Grained Soil		Fine-Grained Soil	Coarse-Grained Soil		Organics and Man-Made Debris
< 5	trace	trace	< 5	trace	trace	< 4	trace
5 - 12	minor	with	5 - 15	minor	minor	4 - 12	some
> 12	some	silty/clayey	15 - 30	with	with		
			> 30	sandy/gravelly	with		

ROCK CLASSIFICATION SYSTEM

STRENGTH	DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH (psi)
Extremely weak (R0)	Easily indented by thumbnail	35 to 150
Very weak (R1)	Scratched with fingernail, peeled by knife, indented by rock pick	150 to 725
Weak (R2)	Peeled by knife, indented by rock pick	725 to 3,500
Medium strong (R3)	Cannot be peeled or scraped with a knife	3,500 to 7,250
Strong (R4)	Requires more than one blow with a rock hammer to fracture it	7,250 to 14,500
Very strong (R5)	Requires many blows with a rock hammer to fracture it	14,500 to 36,250
Extremely strong (R6)	Can only be chipped with a rock hammer	Greater than 36,250

WEATHERING	DESCRIPTION
Decomposed	A soil formed in place with original texture of rock destroyed
Completely weathered	Rock wholly weathered but rock texture preserved
Highly weathered	Rock weakened so that large pieces can be broken by hand
Moderately weathered	Rock mass is decomposed locally
Slightly weathered	Discoloration along discontinuities
Fresh	No visible signs of weathering or discoloring

JOINT SPACING	DESCRIPTION
Very close	Less than 0.2 foot
Close	0.2 foot to 1 foot
Moderately close	1 foot to 3 feet
Wide	3 feet to 10 feet
Very wide	Greater than 10 feet

FRACTURING	FRACTURE SPACING
Very intensely fractured	Chips, fragments, with scattered short core lengths
Intensely fractured	0.1 foot to 0.3 foot with scattered fragments
Moderately fractured	0.3 foot to 1 foot
Slightly fractured	1 foot to 3 feet
Very slightly fractured	Greater than 3 feet
Unfractured	No fractures observed

HEALING	DESCRIPTION
Not healed	Discontinued surface, fractured zone, sheared material, filling is not cemented
Partly healed	Less than 50% of fractures or sheared zone bonding
Moderately healed	Greater than 50% fractures or sheared zone bonding
Totally healed	All fragments are bonded

QUALITY	RQD (percent)
Very poor	Less than 25
Poor	25 to 50
Fair	51 to 75
Good	76 to 90

Rock quality designation (RQD) is a measure of quality of rock core taken from a borehole. The length of core pieces is measured along the center line of the pieces. All pieces of intact rock core equal to or greater than 100 millimeters (4 inches) long are summed and divided by the total length of the core run to obtain RQD value

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TEST PIT NUMBER: TP-1

PROJECT NAME	Modera West Linn	**CLIENT**	MCRT Investments LLC
PROJECT NO.	MCRT-1-01-1	**PROJECT CITY, STATE**	West Linn, Oregon
CONTRACTOR	Dan J. Fischer Excavating, Inc.	**DATE COMPLETED**	08/08/2025
EQUIPMENT	Hitachi ZX40, 2-foot toothed	**TIME STARTED**	12:30 PM
LOGGED BY	S. Chandra	**TIME COMPLETED**	12:45 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (LL-PL-PI)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (12 inches of topsoil, 3-inch-thick root zone). 1.0				
			ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium). 5.0				
	Grab	TP1.1					22	40-27-13	
5	Grab	TP1.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist. 6.0				

Exploration terminated at 6 feet due to refusal on basalt.

GROUNDWATER: Not observed

CAVING: Not observed

TEST PIT NUMBER: TP-2

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Columbia West Engineering, Inc

PROJECT NAME	Modera West Linn	**CLIENT**	MCRT Investments LLC
PROJECT NO.	MCRT-1-01-1	**PROJECT CITY, STATE**	West Linn, Oregon
CONTRACTOR	Dan J. Fischer Excavating, Inc.	**DATE COMPLETED**	08/08/2025
EQUIPMENT	Hitachi ZX40, 2-foot toothed	**TIME STARTED**	12:56 PM
LOGGED BY	S. Chandra	**TIME COMPLETED**	1:09 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 3-inch-thick root zone). 0.7				
			ML/MH		Medium stiff, brown gravelly SILT, moist, medium plasticity, gravel is fine to coarse (colluvium). 4.0				
	Grab	TP2.1					12	61	
					Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist. 5.5				
5	Grab	TP2.2							

Exploration terminated at 5.5 feet due to refusal on basalt.

GROUNDWATER: Not observed

CAVING: Not observed

TEST PIT NUMBER: TP-3

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PROJECT NAME	Modera West Linn	**CLIENT**	MCRT Investments LLC
PROJECT NO.	MCRT-1-01-1	**PROJECT CITY, STATE**	West Linn, Oregon
CONTRACTOR	Dan J. Fischer Excavating, Inc.	**DATE COMPLETED**	08/08/2025
EQUIPMENT	Hitachi ZX40, 2-foot toothed	**TIME STARTED**	1:12 PM
LOGGED BY	S. Chandra	**TIME COMPLETED**	1:20 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 2-inch-thick root zone). 0.7			
			ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium). 1.5			
					Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist. 2.0			
5								

Exploration terminated at 2 feet due to refusal on basalt.

GROUNDWATER: Not observed

CAVING: Not observed

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TEST PIT NUMBER: TP-4

PROJECT NAME Modera West Linn
CLIENT MCRT Investments LLC
PROJECT NO. MCRT-1-01-1
PROJECT CITY, STATE West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc.
DATE COMPLETED 08/09/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed
TIME STARTED 1:35 PM
LOGGED BY S. Chandra
TIME COMPLETED 1:48 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
0.8					Medium stiff, brown SILT with gravel, trace organics (roots), moist (10 inches of topsoil, 3-inch-thick root zone).				
5.0			ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).				
	Grab	TP4.1					13	76	
5.5	Grab	TP4.2			Medium strong to strong (R3-R4), gray BASALT, decomposed to moderately weathered, very close to close jointed, weak to moderate induration, moist.				

Exploration terminated at 5.5 feet due to refusal on basalt.

GROUNDWATER: Not observed

CAVING: Not observed

BoreDM Template: Test Pit Template - New

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TEST PIT NUMBER: TP-5

PROJECT NAME Modera West Linn
CLIENT MCRT Investments LLC
PROJECT NO. MCRT-1-01-1
PROJECT CITY, STATE West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc.
DATE COMPLETED 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed
TIME STARTED 2:00 PM
LOGGED BY S. Chandra
TIME COMPLETED 2:15 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
0.8					Medium stiff, brown SILT with gravel, trace organics (roots), moist (10 inches of topsoil, 3-inch-thick root zone).			
3.0	Grab	TP5.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).		18	
4.0	Grab	TP5.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist.			

Exploration terminated at 4 feet due to refusal on basalt.

5

GROUNDWATER: Not observed

CAVING: Not observed

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TEST PIT NUMBER: TP-6

PROJECT NAME Modera West Linn
CLIENT MCRT Investments LLC
PROJECT NO. MCRT-1-01-1
PROJECT CITY, STATE West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc.
DATE COMPLETED 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed
TIME STARTED 2:19 PM
LOGGED BY S. Chandra
TIME COMPLETED 2:25 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 3-inch-thick root zone). 0.7				
	Grab	TP6.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium). 2.0		23		
	Grab	TP6.2	ML/MH		Stiff to very stiff, brown-gray gravelly SILT with cobbles, moist, gravel is fine to coarse (decomposed to weathered basalt). 4.0		19	52	
5					Exploration terminated at 4 feet due to refusal on basalt.				

GROUNDWATER: Not observed

CAVING: Not observed

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TEST PIT NUMBER: TP-7

PROJECT NAME Modera West Linn
CLIENT MCRT Investments LLC
PROJECT NO. MCRT-1-01-1
PROJECT CITY, STATE West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc.
DATE COMPLETED 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed
TIME STARTED 2:28 PM
LOGGED BY S. Chandra
TIME COMPLETED 2:40 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS (LL-PL-PI)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (10 inches of topsoil, 3-inch-thick root zone). 0.8				
	Grab	TP7.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium). 2.0		17	50-34-16	
	Grab	TP7.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist. 3.0				
					Exploration terminated at 3 feet due to refusal on basalt.				
5									

GROUNDWATER: Not observed

CAVING: Not observed

TEST PIT NUMBER: TP-8

PROJECT NAME Modera West Linn | **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 | **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. | **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed | **TIME STARTED** 2:47 PM
LOGGED BY S. Chandra | **TIME COMPLETED** 2:57 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (12 inches of topsoil, 5-inch-thick root zone). 1.0			
	Grab	TP8.1	GM		Medium dense to very dense, brown-gray silty GRAVEL with sand and cobbles, moist (decomposed to weathered basalt). Trace organics (rootlets) at 2 feet. 3.0		33	
5					Exploration terminated at 3 feet due to refusal on basalt.			

GROUNDWATER: Not observed

CAVING: Not observed

TEST PIT NUMBER: TP-9

PROJECT NAME Modera West Linn
CLIENT MCRT Investments LLC
PROJECT NO. MCRT-1-01-1
PROJECT CITY, STATE West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc.
DATE COMPLETED 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed
TIME STARTED 3:05 PM
LOGGED BY S. Chandra
TIME COMPLETED 3:15 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 3-inch-thick root zone). 0.7				
			GM		Medium dense to very dense, brown-gray silty GRAVEL with sand and cobbles, moist (decomposed to weathered basalt).				
	Grab	TP9.1			3.0		11	25	
5					Exploration terminated at 3 feet due to refusal on basalt.				

GROUNDWATER: Not observed

CAVING: Not observed

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TEST PIT NUMBER: TP-10

PROJECT NAME Modera West Linn
CLIENT MCRT Investments LLC
PROJECT NO. MCRT-1-01-1
PROJECT CITY, STATE West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc.
DATE COMPLETED 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed
TIME STARTED 3:32 PM
LOGGED BY S. Chandra
TIME COMPLETED 3:50 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
0.0–1.0					Medium stiff, brown SILT with gravel, trace organics (roots), moist (12 inches of topsoil, 4-inch-thick root zone). 1.0			
1.0–4.0	Grab	TP10.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium). 4.0		12	
4.0–5.0	Grab	TP10.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist. 5.0			
5					Exploration terminated at 5 feet due to refusal on basalt.			

GROUNDWATER: Not observed

CAVING: Not observed

APPENDIX B

APPENDIX B
LABORATORY TESTING

GENERAL
Laboratory testing was conducted on select soil and rock samples collected in the field to confirm field classifications and determine the index engineering properties. The laboratory classifications are shown on the exploration logs if those classifications differed from the field classifications. The locations of the tested samples are shown on the exploration logs. Descriptions of the tests are presented below and the test results are presented in this appendix.

PARTICLE-SIZE ANALYSIS
Particle-size analyses were completed on select soil samples in general accordance with ASTM D1140 (P200). This test is a quantitative determination of the percent passing the U.S. Standard No. 200 sieve by dry weight of the specimen.

MOISTURE CONTENT DETERMINATION
The natural moisture content of select soil samples was determined in general accordance with ASTM D 2216. The natural moisture content is a ratio of the weight of the water to dry soil in a test sample and is expressed as a percentage.

ATTERBERG LIMITS TESTING
Atterberg limits (plastic and liquid limits) testing was performed on select soil samples in general accordance with ASTM D4318. The plastic limit is defined as the moisture content where the soil becomes brittle. The liquid limit is defined as the moisture content where the soil begins to act similar to a liquid. The plasticity index is the difference between the liquid and plastic limits.

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www.columbia-west.com

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MOISTURE CONTENT, PERCENT PASSING NO. 200 SIEVE BY WASHING

PROJECT	CLIENT	PROJECT NO.	
Moderna West Linn West Linn, Oregon	MCRT Investments LLC 720 SW Washington Street, Suite 720 Portland, OR 97205	MCRT-1-01-1	
		ISSUE DATE: 08/21/25	PAGE: 1 of 1
		DATE SAMPLED: 08/08/25	SAMPLED BY: S. Chandra

LABORATORY TEST DATA

TEST PROCEDURE
ASTM D2216 - Method A, ASTM D1140

LAB ID	CONTAINER MASS (g)	MOIST MASS + CONTAINER (g)	DRY MASS + CONTAINER (g)	AFTER WASH DRY MASS + CONTAINER (g)	FIELD ID	SAMPLE DEPTH (ft)	PERCENT MOISTURE CONTENT	PERCENT PASSING NO. 200 SIEVE
S25-1668	86.38	362.99	313.18	-	TP1.1	2	22%	-
S25-1669	574.85	860.98	829.57	674.67	TP2.1	2.5	12%	61%
S25-1670	550.40	969.18	922.53	639.68	TP4.1	2.5	13%	76%
S25-1671	87.94	235.35	213.33	-	TP5.1	2.5	18%	-
S25-1672	87.42	275.70	240.46	-	TP6.1	1	23%	-
S25-1673	1,538.1	4,958.4	4,420.4	2,912.6	TP6.2	2.5	19%	52%
S25-1674	87.70	373.48	331.38	-	TP7.1	1	17%	-
S25-1675	787.4	2,252.3	1,886.3	-	TP8.1	2.5	33%	-
S25-1676	1,535.3	5,540.5	5,156.5	4,246.4	TP9.1	2.5	11%	25%
S25-1677	776.3	1,895.9	1,774.0	-	TP10.1	2.5	12%	-

NOTES:
Sample weight received for Lab ID: S25-1673, and 1676 did not meet the minimum size requirements; entire sample used for analysis.

DATE TESTED	TESTED BY
08/14/25	G. Hausmann, L. Gunderson

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ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	
Moderna West Linn West Linn, Oregon	MCRT Investments LLC 720 SW Washington Street, Suite 720 Portland, OR 97205	MCRT-1-01-1	
		ISSUE DATE 08/21/25	PAGE 1 of 1
		LAB ID S25-1668	FIELD ID TP1.1
		DATE SAMPLED 08/08/25	SAMPLED BY S. Chandra

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
SILT with Gravel	Test Pit TP-1 depth = 2 feet	no data provided

LABORATORY TEST DATA

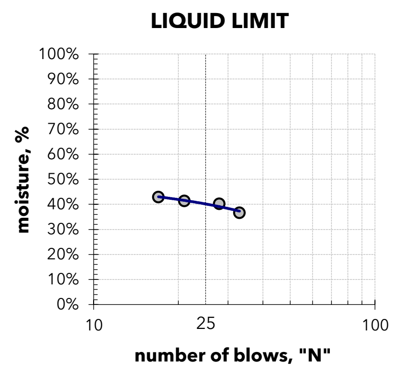
LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318 - Method A

ATTERBERG LIMITS

liquid limit =	40
plastic limit =	27
plasticity index =	13

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	33.16	32.80	31.06	29.69
dry soil + pan weight, g =	29.90	29.41	28.12	27.03
pan weight, g =	20.99	20.97	21.01	20.82
N (blows) =	33	28	21	17
moisture, % =	36.6 %	40.2 %	41.4 %	42.8 %

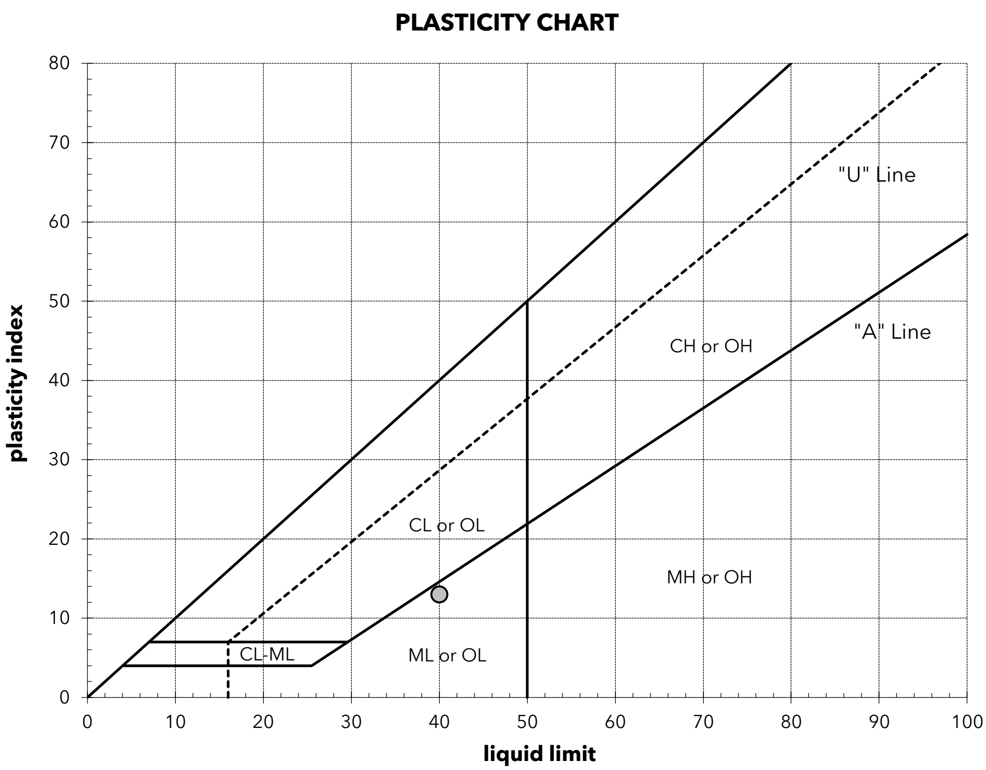


SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.16	27.17		
dry soil + pan weight, g =	25.84	25.88		
pan weight, g =	20.87	21.01		
moisture, % =	26.6 %	26.5 %		



ADDITIONAL DATA

% gravel =	n/a
% sand =	n/a
% silt and clay =	n/a
% silt =	n/a
% clay =	n/a
moisture content =	22%

DATE TESTED	TESTED BY
08/19/25	G. Hausmann

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Engineering, Inc

ATTERBERG LIMITS REPORT

PROJECT	CLIENT	PROJECT NO.	
Moderna West Linn West Linn, Oregon	MCRT Investments LLC 720 SW Washington Street, Suite 720 Portland, OR 97205	MCRT-1-01-1	
		ISSUE DATE 08/21/25	PAGE 1 of 1
		LAB ID S25-1674	FIELD ID TP7.1
		DATE SAMPLED 08/08/25	SAMPLED BY S. Chandra

MATERIAL DATA

MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE
Gravelly SILT with Sand	Test Pit TP-7 depth = 1 foot	no data provided

LABORATORY TEST DATA

LABORATORY EQUIPMENT	TEST PROCEDURE
Liquid Limit Machine, Hand Rolled	ASTM D4318 - Method A

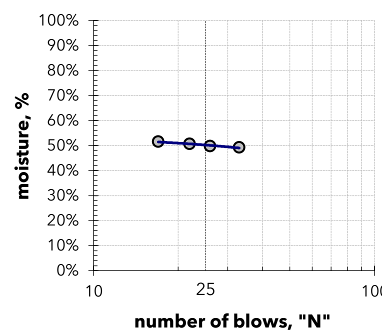
ATTERBERG LIMITS

liquid limit =	50
plastic limit =	34
plasticity index =	16

LIQUID LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	31.09	31.61	31.24	29.81
dry soil + pan weight, g =	27.76	28.09	27.60	26.62
pan weight, g =	20.99	21.01	20.42	20.43
N (blows) =	33	26	22	17
moisture, % =	49.2 %	49.7 %	50.7 %	51.5 %

LIQUID LIMIT



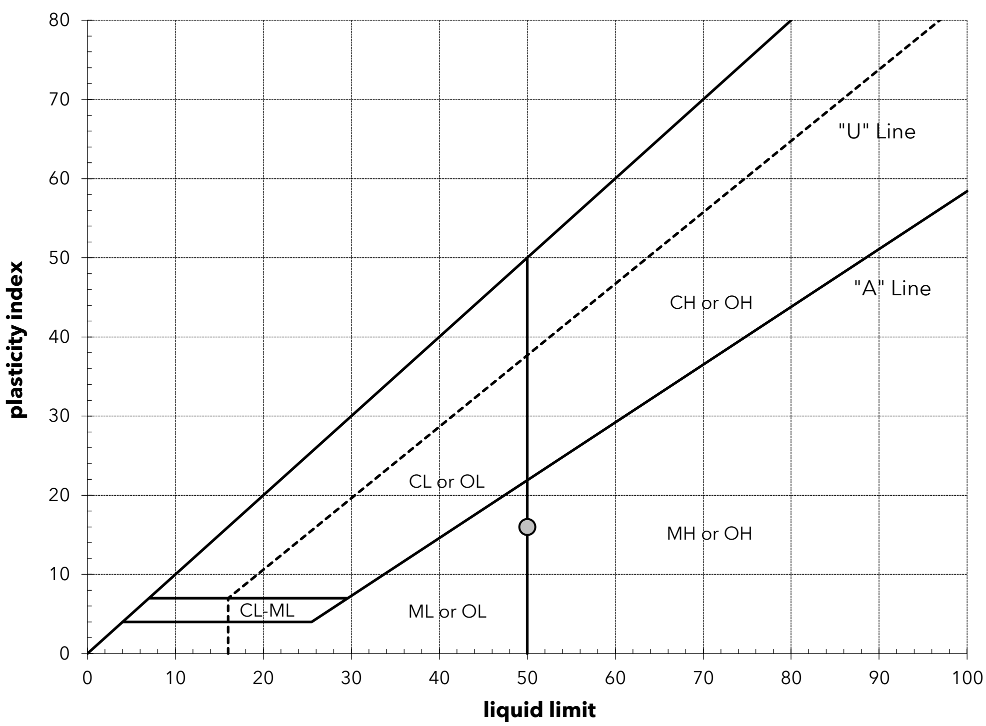
SHRINKAGE

shrinkage limit =	n/a
shrinkage ratio =	n/a

PLASTIC LIMIT DETERMINATION

	❶	❷	❸	❹
wet soil + pan weight, g =	27.95	27.82		
dry soil + pan weight, g =	26.15	26.09		
pan weight, g =	20.87	21.02		
moisture, % =	34.1 %	34.1 %		

PLASTICITY CHART



ADDITIONAL DATA

% gravel =	n/a
% sand =	n/a
% silt and clay =	n/a
% silt =	n/a
% clay =	n/a
moisture content =	17%

DATE TESTED	TESTED BY
08/18/25	G. Hausmann

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APPENDIX C

APPENDIX C
SUBSURFACE EXPLORATION BY OTHERS

This appendix presents figures, exploration logs, and laboratory test results associated with subsurface exploration programs conducted by GeoDesign at the site on February 23, 2006, and February 20, 2014. The 2006 subsurface exploration program included 16 test pits to depths between 3.3 and 11 feet BGS. The 2014 subsurface exploration program included 17 test pits to depths between 4 and 13.5 feet BGS. The figures, test pit logs, and laboratory test results were appended to the following geotechnical engineering reports:

- *Report of Geotechnical Engineering Services; Willamette 205 Corporate Center; Blankenship Road and Tannler Drive; West Linn, Oregon,* dated July 7, 2006
- *Report of Geotechnical Engineering Services; NWC of Tannler & Blankenship; Tannler Drive and Blankenship Road; West Linn, Oregon,* dated July 28, 2014

EXPLANATION:

TP-1 TEST PIT

(5) DEPTH TO INTACT BEDROCK

NOTE:

(11+) INDICATES THAT BEDROCK WAS NOT ENCOUNTERED

SITE PLAN BASED ON DRAWING PROVIDED BY GROUP MACKENZIE

Jul 07, 2006 - 07:57:21 DWG Name: BlackHawk-1-01-SP-FIGURE-2.dwg Updated By: akd

FIGURE 2

SITE PLAN

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

BLACKHAWK-1-01

JULY 2006

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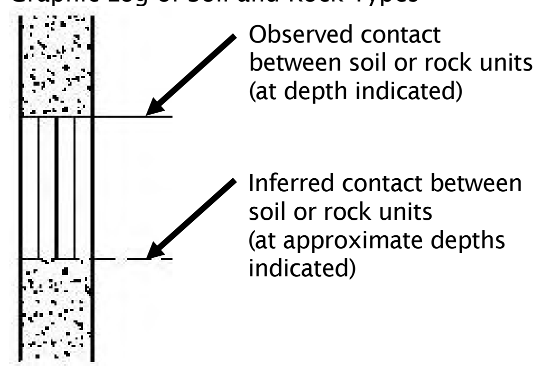
KEY TO TEST PIT AND BORING LOG SYMBOLS

SYMBOL	SAMPLING DESCRIPTION
	Location of sample obtained in general accordance with ASTM D 1586 Standard Penetration Test with recovery
	Location of sample obtained using thin wall, shelby tube, or Geoprobe® sampler in general accordance with ASTM D 1587 with recovery
	Location of sample obtained using Dames & Moore sampler and 300-pound hammer or pushed with recovery
	Location of sample obtained using Dames & Moore sampler and 140-pound hammer or pushed with recovery
	Location of grab sample
	Rock coring interval
	Water level during drilling
	Water level taken on date shown

Graphic Log of Soil and Rock Types



GEOTECHNICAL TESTING EXPLANATIONS

PP	Pocket Penetrometer	DD	Dry Density
TOR	Torvane	ATT	Atterberg Limits
CON	Consolidation	CBR	California Bearing Ratio
DS	Direct Shear	OC	Organic Content
P200	Percent Passing U.S. Standard No. 200 Sieve	P	Pushed Sample
HYD	Hydrometer Gradation	RES	Resilient Modulus
UC	Unconfined Compressive Strength	VS	Vane Shear
SIEV	Sieve Gradation	kPa	kiloPascal

ENVIRONMENTAL TESTING EXPLANATIONS

CA	Sample Submitted for Chemical Analysis	ND	Not Detected
PID	Photoionization Detector Headspace Analysis	NS	No Visible Sheen
ppm	Parts Per Million	SS	Slight Sheen
P	Pushed Sample	MS	Moderate Sheen
		HS	Heavy Sheen

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KEY TO TEST PIT AND BORING LOG SYMBOLS

TABLE A-1

SOIL CLASSIFICATION SYSTEM

CONSISTENCY - COARSE-GRAINED SOILS

Relative Density	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)
Very Loose	0 – 4	0 - 11	0 - 4
Loose	4 – 10	11 - 26	4 - 10
Medium Dense	10 – 30	26 - 74	10 - 30
Dense	30 – 50	74 - 120	30 - 47
Very Dense	More than 50	More than 120	More than 47

CONSISTENCY - FINE-GRAINED SOILS

Consistency	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)	Unconfined Compressive Strength (tsf)
Very Soft	Less than 2	Less than 3	Less than 2	Less than 0.25
Soft	2 - 4	3 – 6	2 - 5	0.25 - 0.50
Medium Stiff	4 - 8	6 – 12	5 - 9	0.50 - 1.0
Stiff	8 - 15	12 – 25	9 - 19	1.0 - 2.0
Very Stiff	15 - 30	25 – 65	19 – 31	2.0 - 4.0
Hard	More than 30	More than 65	More than 31	More than 4.0

SOIL CLASSIFICATION NAME

Name and Modifier Terms		Constituent Percentage
Coarse-grained	GRAVEL, SAND	>50%
	sandy, gravelly	30 - 50%
	silty, clayey	15 - 50%
	some (gravel, sand)	15 - 30%
	some (silt, clay)	5 - 15%
	trace (gravel, sand)	
	trace (silt, clay)	<5%
Fine-grained	CLAY, SILT	>50%
	silty, clayey	30 - 50%
	sandy, gravelly	
	some (sand, gravel)	15 - 30%
	some (silt, clay)	
	trace (sand, gravel)	5 - 15%
	trace (silt, clay)	
Organic	PEAT	50 - 100%
	organic (soil name)	15 - 50%
	(soil name) with some organics	5 - 15%

MOISTURE CLASSIFICATION

Term	Field Test
dry	very low moisture, dry to touch
moist	damp, without visible moisture
wet	visible free water, usually saturated

GRAIN SIZE CLASSIFICATION

Description		Sieve*	Observed Size
boulders		-	>12”
cobbles		-	3” - 12”
gravel	coarse	0.75” - 3”	0.75” - 3”
	fine	#4 - 0.75”	0.19” - 0.75”
sand	coarse	#10 - #4	0.079” - 0.19”
	medium	#40 - #10	0.017” - 0.079”
	fine	#200 - #40	00029” - 0.017”
fines		<#200	<0.0029”

* Use of #200 field sieve encouraged

ROCK CLASSIFICATION GUIDELINES

HARDNESS	DESCRIPTION
Extremely Soft (R0)	Indented by thumbnail
Very Soft (R1)	Can be peeled by pocket knife or scratched with finger nail
Soft (R2)	Can be peeled by a pocket knife with difficulty
Medium Hard (R3)	Can be scratched by knife or pick
Hard (R4)	Can be scratched with knife or pick only with difficulty
Very Hard (R5)	Cannot be scratched with knife or sharp pick

WEATHERING	DESCRIPTION
Decomposed	Rock mass is completely decomposed
Predominantly Decomposed	Rock mass is more than 50% decomposed
Moderately Weathered	Rock mass is decomposed locally
Slightly Weathered	Rock mass is generally fresh
Fresh	No discoloration in rock fabric

JOINT SPACING	DESCRIPTION
Very Close	Less than 2 inches
Close	2 inches to 1 foot
Moderate Close	1 foot to 3 feet
Wide	3 feet to 10 feet
Very Wide	Greater than 10 feet

FRACTURING	FRACTURE SPACING
Very Intensely Fractured	Chips and fragments with a few scattered short core lengths
Intensely Fractured	0.1 foot to 0.3 foot with scattered fragments intervals
Moderately Fractured	0.3 foot to 1 foot with most lengths 0.6 foot
Slightly Fractured	1 foot to 3 feet
Very Slightly Fractured	Greater than 3 feet
Unfractured	No fractures

HEALING	DESCRIPTION
Not Healed	Discontinuity surface, fractured zone, sheared material or filling not re-cemented
Partly Healed	Less than 50% of fractured or sheared material
Moderately Healed	Greater than 50% of fractured or sheared material
Totally Healed	All fragments bonded

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TP-1

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	COMMENTS
0.0	Stiff, brown SILT with trace to some gravel; dry to moist (3-inch-thick root zone). becomes gravelly at 1.5 feet				
2.5	Very dense, brown GRAVEL with trace to some silt and cobbles; dry to moist, angular.	2.5			
	Stiff to very stiff, brown, gravelly SILT; moist.	3.5	P200	☒	P200 = 55%
5.0	Very dense, brown, fine to coarse GRAVEL with some cobbles and trace silt; dry to moist, angular (moderately weathered basalt).	5.0			
7.5	Very stiff to hard, brown SILT with some clay and trace to no gravel; dry to moist.	7.8		☒	
10.0				☒	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
	Test pit completed at 11.0 feet.	11.0			
12.5					

TP-2

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	COMMENTS
0.0	Medium stiff to stiff, dark brown SILT with some gravel; dry to moist.				
2.5	Soft (R2), black and brown BASALT; predominately decomposed, vesicular, closely fractured.	1.8		☒	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
	Test pit completed at 3.3 feet due to refusal on basalt.	3.3			
5.0					
7.5					
10.0					
12.5					

● MOISTURE CONTENT % (0 – 50 – 100)

EXCAVATED BY: Western States Soil Conservation, Inc. LOGGED BY: BBP COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)

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BLACKHAWK-1-01

JULY 2006

TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-1

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS

TP-3

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	COMMENTS
0.0	Stiff, brown SILT with trace clay; dry to moist (6-inch-thick root zone).		
4.1	grades with trace gravel and cobbles at 4.0 feet	4.1	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
4.3	Soft to medium hard (R2-R3), light gray-brown BASALT; moderately to slightly weathered, closely fractured.	4.3	
	Test pit completed at 4.3 feet due to refusal on basalt.		

TP-4

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	COMMENTS
0.0	Stiff, brown SILT with trace to some clay; moist (5-inch-thick root zone).		
	grades to light brown and clayey with brown and black mottles at 3.0 feet		
	grades with trace gravel and angular cobbles (colluvium) at 5.0 feet		
	encountered single cobble (10-inch diameter) at 5.5 feet		
6.0	Dense to very dense, yellow-gray GRAVEL with some cobbles and trace silt; dry to moist, angular (colluvium).	6.0	
6.5	Dense to very dense, yellow-gray, fine to coarse SAND with some clay and trace fine gravel; moist, subrounded to angular.	6.5	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
7.2	Test pit completed at 7.2 feet due to refusal on basalt.	7.2	

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EXCAVATION METHOD: backhoe (see report text)

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BLACKHAWK-1-01

JULY 2006

TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-2

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS

TP-5

Depth	Material Description	Elevation/Depth	Comments
0.0	Stiff, brown SILT with trace clay; moist (3-inch-thick root zone).		
3.0	Soft to medium hard (R2-R3), gray BASALT with brown staining; moderate to slightly weathered, slightly fractured (1- to 8-inch spacing).	3.0	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
3.7	Test pit completed at 3.7 feet due to refusal on basalt.	3.7	

Moisture content scale: 0 50 100

TP-6

Depth	Material Description	Elevation/Depth	Comments
0.0	Stiff, brown SILT with trace to some gravel and cobbles and trace clay; dry to moist (8-inch-thick root zone).		
3.0	Stiff, dark brown, gravelly SILT with some organics; dry to moist (colluvium).	3.0	
4.0	Stiff, dark brown SILT with trace to some gravel and some organics; dry to moist (colluvium). grades to no gravel at 5.5 feet	4.0	
10.2	Test pit completed at 10.2 feet.	10.2	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.

Moisture content scale: 0 50 100

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EXCAVATION METHOD: backhoe (see report text)

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TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-3

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
TP-7							
0.0		Stiff, brown SILT with trace clay; dry to moist (4-inch-thick root zone).					
2.5		encountered two boulders (14-inch diameter) at 3.0 feet					
		grades with some gravel and cobbles at 3.5 feet	4.0				
5.0		Soft to medium hard (R2-R3), gray BASALT with brown staining; moderately weathered, closely fractured (1 to 6 inches), slightly fractured.					
7.5		grades to extremely soft to very soft (R0-R1) at approximately 7.0 feet			☒		No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
		grades to red-brown with yellow breccia at 7.5 feet	8.0				
		Test pit completed at 8.0 feet due to refusal on basalt.					
10.0							
12.5							
TP-8							
0.0		Medium stiff to stiff, brown SILT with trace clay; moist (2-inch-thick root zone).					
2.5		grades to yellow-brown with some clay at 3.5 feet					
5.0							
		Very dense, brown, silty GRAVEL; dry to moist, poorly graded, angular, few cobbles up to 8-inch diameter (colluvium).	5.5				
		Hard, brown, clayey SILT; dry.	6.5		☒	●	
7.5		Extremely soft (R0), dark gray BASALT with brown stains; decomposed to intensely weathered.	7.5		☒	●	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
		Test pit completed at 9.0 feet.	9.0				
10.0							
12.5							

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EXCAVATION METHOD: backhoe (see report text)

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TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-4

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
TP-9							
0.0		Stiff, brown SILT with trace to some clay; moist (7-inch-thick root zone).					
5.0		grades to no clay at 4.5 feet			☒	●	
7.5		Dense to very dense, brown, fine to coarse GRAVEL with some fine to coarse sand and silt; moist, poorly graded, subrounded to subangular.	8.0				Minor caving observed at 8.0 feet.
10.0				P200	☒	●	P200 = 18% No groundwater seepage observed to the depth explored.
		Test pit completed at 10.7 feet.	10.7				
12.5							
TP-10							
0.0		Medium stiff to stiff, brown SILT with trace to some clay; moist (6-inch-thick root zone).			☒	●	
5.0		Dense to very dense, brown-gray, fine to coarse GRAVEL with some fine to coarse cobbles and silt and trace sand; moist, subrounded to subangular.	4.5	P200	☒	●	P200 = 24%
7.5		grades to very fractured, decomposed basalt at 7.0 feet			☒		No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
		Test pit completed at 8.8 feet.	8.8				
10.0							
12.5							

Moisture content scale: 0 50 100

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EXCAVATION METHOD: backhoe (see report text)

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TEST PIT

WILLAMETTE 205 CORPORATE CENTER
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FIGURE A-5

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 – 50 – 100)	COMMENTS
TP-11							
0.0		Medium stiff, dark brown SILT with trace to some gravel and trace clay; moist (fill).					
4.0		Stiff, brown SILT with trace to some clay; dry to moist, few roots.	4.0				
6.0		Dense to very dense, brown-gray GRAVEL with some silt and cobbles; moist, angular (colluvium).	6.0				
9.0		Extremely soft to very soft (R0-R1), yellow-gray BASALT; decomposed, closely fractured (1 to 5 inches).	9.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
10.0		Test pit completed at 10.0 feet.	10.0				
TP-12							
0.0		Medium stiff to stiff, brown SILT with some clay; moist (7-inch-thick root zone).					
3.5		Stiff, gray-brown, clayey SILT with brown mottles; moist.	3.5				
5.0		Very dense, brown-gray GRAVEL with some cobbles and trace sand and silt; moist, subrounded to angular.	5.0				
		grades to fine to coarse with some sand and silt at 8.5 feet					
		becomes subrounded to subangular at 9.0 feet					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
10.8		Test pit completed at 10.8 feet.	10.8				

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EXCAVATION METHOD: backhoe (see report text)

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BLACKHAWK-1-01	**TEST PIT**	
JULY 2006	WILLAMETTE 205 CORPORATE CENTER WEST LINN, OR	**FIGURE A-6**

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
TP-13							
0.0		Stiff, brown SILT with trace to some clay; moist (8-inch-thick root zone)					
2.5		becomes blocky with trace clay at 2.0 feet			☒	●	
		Dense to very dense, fine to coarse GRAVEL with trace to some silt, sand, and cobbles; dry to moist, subrounded to angular (colluvium).	3.0				
5.0							
7.5							
10.0					☒		No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
		Test pit completed at 11.0 feet.	11.0				
12.5							
TP-14							
0.0		Stiff, brown SILT with trace sand; moist (8-inch-thick root zone).					
		grades to gravelly at 1.5 feet					
2.5							
		Extremely soft to soft (R0-R2), gray-brown BASALT; moderately weathered, closely fractured (2 to 6 inches).	3.0				
					☒	●	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
5.0		Test pit completed at 5.0 feet due to refusal on basalt.	5.0				
7.5							
10.0							
12.5							

EXCAVATED BY: Western States Soil Conservation, Inc.   LOGGED BY: BBP   COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 – 50 – 100)	COMMENTS

TP-15

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	SAMPLE	COMMENTS
0.0	Dense, brown, silty GRAVEL; dry to moist, poorly graded, angular (fill).	0.7		
	Stiff, dark brown SILT with some organics; dry to moist.	2.0		
2.5	Very soft to soft (R1-R2), brown BASALT with black stains; moderately to slightly weathered, closely fractured (2 to 8 inches), blocky.	3.3	☒	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
	Test pit completed at 3.3 feet due to refusal on basalt.			
5.0				
7.5				
10.0				
12.5				

TP-16

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	SAMPLE	MOISTURE CONTENT %	COMMENTS
0.0	Stiff, brown, gravelly SILT with trace sand; dry to moist; angular gravel (5-inch-thick root zone).	3.0			
2.5	Dense to very dense, gray-brown GRAVEL with trace to some silt, sand, and cobbles; dry to moist, poorly graded, subrounded to subangular (colluvium).	11.0			
5.0					
7.5					
10.0	Test pit completed at 11.0 feet.		☒	●	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
12.5					

EXCAVATED BY: Western States Soil Conservation, Inc. LOGGED BY: BBP COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)

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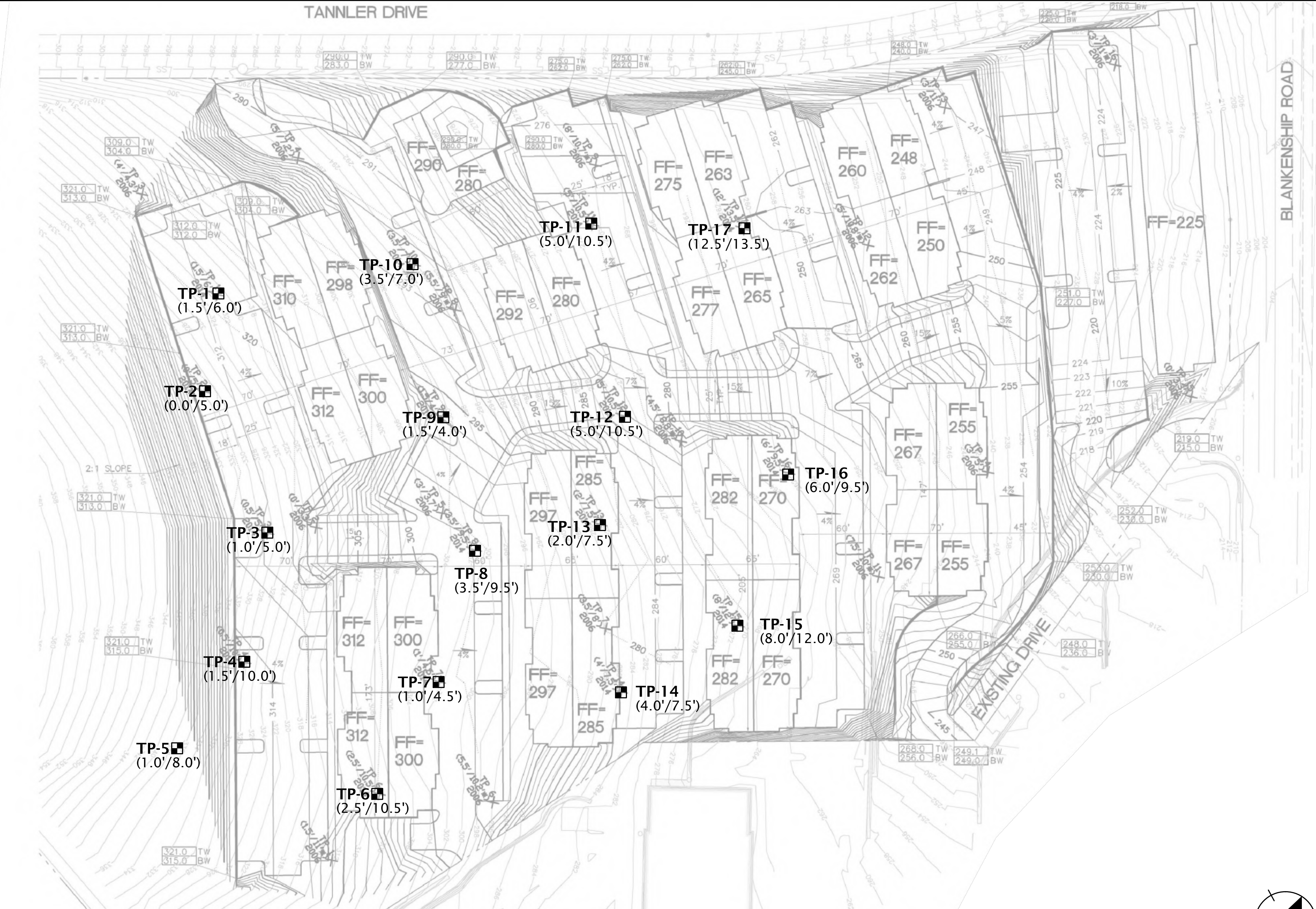
BLACKHAWK-1-01	TEST PIT	
JULY 2006	WILLAMETTE 205 CORPORATE CENTER WEST LINN, OR	**FIGURE A-8**



N

0 100 200

(SCALE IN FEET)

LEGEND:

TP-1 (1.5'/11.0') — TEST PIT — DEPTH TO WEATHERED BASALT/DEPTH TO INTACT BASALT

SITE PLAN BASED ON IMAGE OBTAINED FROM CONAM PROPERTIES, JULY 23, 2014

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CONAM-1-01

JULY 2014

SITE PLAN

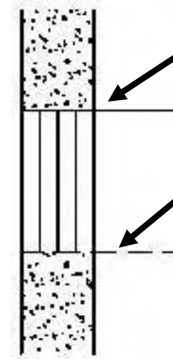
NWC OF TANNLER & BLANKENSHIP
WEST LINN, OR

FIGURE 2

Printed By: mmiller | Print Date: 7/28/2014 11:10:25 AM
File Name: J:\A-D\ConAm\ConAm-1\ConAm-1-01\Figures\CAD\ConAm-1-01-SP01.dwg | Layout: FIGURE 2

SYMBOL	SAMPLING DESCRIPTION
	Location of sample obtained in general accordance with ASTM D 1586 Standard Penetration Test with recovery
	Location of sample obtained using thin-wall Shelby tube or Geoprobe® sampler in general accordance with ASTM D 1587 with recovery
	Location of sample obtained using Dames & Moore sampler and 300-pound hammer or pushed with recovery
	Location of sample obtained using Dames & Moore and 140-pound hammer or pushed with recovery
	Location of sample obtained using 3-inch-O.D. California split-spoon sampler and 140-pound hammer
	Location of grab sample
	Rock coring interval
	Water level during drilling
	Water level taken on date shown

Graphic Log of Soil and Rock Types



GEOTECHNICAL TESTING EXPLANATIONS

ATT	Atterberg Limits	PP	Pocket Penetrometer
CBR	California Bearing Ratio	P200	Percent Passing U.S. Standard No. 200 Sieve
CON	Consolidation		
DD	Dry Density	RES	Resilient Modulus
DS	Direct Shear	SIEV	Sieve Gradation
HYD	Hydrometer Gradation	TOR	Torvane
MC	Moisture Content	UC	Unconfined Compressive Strength
MD	Moisture-Density Relationship	VS	Vane Shear
OC	Organic Content	kPa	Kilopascal
P	Pushed Sample		

ENVIRONMENTAL TESTING EXPLANATIONS

CA	Sample Submitted for Chemical Analysis	ND	Not Detected
P	Pushed Sample	NS	No Visible Sheen
PID	Photoionization Detector Headspace Analysis	SS	Slight Sheen
		MS	Moderate Sheen
ppm	Parts per Million	HS	Heavy Sheen

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EXPLORATION KEY

TABLE A-1

RELATIVE DENSITY - COARSE-GRAINED SOILS

Relative Density	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)
Very Loose	0 – 4	0 - 11	0 - 4
Loose	4 – 10	11 - 26	4 - 10
Medium Dense	10 – 30	26 - 74	10 - 30
Dense	30 – 50	74 - 120	30 - 47
Very Dense	More than 50	More than 120	More than 47

CONSISTENCY - FINE-GRAINED SOILS

Consistency	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)	Unconfined Compressive Strength (tsf)
Very Soft	Less than 2	Less than 3	Less than 2	Less than 0.25
Soft	2 - 4	3 – 6	2 - 5	0.25 - 0.50
Medium Stiff	4 - 8	6 – 12	5 - 9	0.50 - 1.0
Stiff	8 - 15	12 – 25	9 - 19	1.0 - 2.0
Very Stiff	15 - 30	25 – 65	19 – 31	2.0 - 4.0
Hard	More than 30	More than 65	More than 31	More than 4.0

PRIMARY SOIL DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE-GRAINED SOILS (more than 50% retained on No. 200 sieve)	GRAVEL (more than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVELS (< 5% fines)	GW or GP	GRAVEL
		GRAVEL WITH FINES (≥ 5% and ≤ 12% fines)	GW-GM or GP-GM	GRAVEL with silt
			GW-GC or GP-GC	GRAVEL with clay
		GRAVELS WITH FINES (> 12% fines)	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND (50% or more of coarse fraction passing No. 4 sieve)	CLEAN SANDS (<5% fines)	SW or SP	SAND
		SANDS WITH FINES (≥ 5% and ≤ 12% fines)	SW-SM or SP-SM	SAND with silt
			SW-SC or SP-SC	SAND with clay
		SANDS WITH FINES (> 12% fines)	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOILS (50% or more passing No. 200 sieve)	SILT AND CLAY	Liquid limit less than 50	ML	SILT
			CL	CLAY
			CL-ML	silty CLAY
			OL	ORGANIC SILT or ORGANIC CLAY
		Liquid limit 50 or greater	MH	SILT
			CH	CLAY
			OH	ORGANIC SILT or ORGANIC CLAY
HIGHLY ORGANIC SOILS			PT	PEAT

MOISTURE CLASSIFICATION

Term	Field Test
dry	very low moisture, dry to touch
moist	damp, without visible moisture
wet	visible free water, usually saturated

ADDITIONAL CONSTITUENTS

Secondary granular components or other materials such as organics, man-made debris, etc.

Percent	Silt and Clay In: Fine-Grained Soils	Silt and Clay In: Coarse-Grained Soils	Percent	Sand and Gravel In: Fine-Grained Soils	Sand and Gravel In: Coarse-Grained Soils
< 5	trace	trace	< 5	trace	trace
5 – 12	minor	with	5 – 15	minor	minor
> 12	some	silty/clayey	15 – 30	with	with
			> 30	sandy/gravelly	Indicate %

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SOIL CLASSIFICATION SYSTEM

TABLE A-2

HARDNESS	DESCRIPTION
Extremely Soft (R0)	Indented by thumbnail
Very Soft (R1)	Can be peeled by pocket knife or scratched with finger nail
Soft (R2)	Can be peeled by a pocket knife with difficulty
Medium Hard (R3)	Can be scratched by knife or pick
Hard (R4)	Can be scratched with knife or pick only with difficulty
Very Hard (R5)	Cannot be scratched with knife or sharp pick
WEATHERING	**DESCRIPTION**
Decomposed	Rock mass is completely decomposed
Predominantly Decomposed	Rock mass is more than 50% decomposed
Moderately Weathered	Rock mass is decomposed locally
Slightly Weathered	Rock mass is generally fresh
Fresh	No discoloration in rock fabric
JOINT SPACING	**DESCRIPTION**
Very Close	Less than 2 inches
Close	2 inches to 1 foot
Moderate Close	1 foot to 3 feet
Wide	3 feet to 10 feet
Very Wide	Greater than 10 feet
FRACTURING	**FRACTURE SPACING**
Very Intensely Fractured	Chips and fragments with a few scattered short core lengths
Intensely Fractured	0.1 foot to 0.3 foot with scattered fragments intervals
Moderately Fractured	0.3 foot to 1 foot with most lengths 0.6 foot
Slightly Fractured	1 foot to 3 feet
Very Slightly Fractured	Greater than 3 feet
Unfractured	No fractures
HEALING	**DESCRIPTION**
Not Healed	Discontinuity surface, fractured zone, sheared material or filling not re-cemented
Partly Healed	Less than 50% of fractured or sheared material
Moderately Healed	Greater than 50% of fractured or sheared material
Totally Healed	All fragments bonded

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ROCK CLASSIFICATION SYSTEM

TABLE A-3

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, brown SILT (ML), abundant shrub roots; moist (2-inch-thick root zone).					
		Very soft to soft (R1-R2), gray-brown BASALT; decomposed to intensely weathered, moderately to intensely fractured.	1.5				
2.5							
		soft to medium hard (R2-R3), gray; moderately to intensely weathered, moderately fractured at 4.0 feet					
5.0					☒		
		Exploration terminated at a depth of 6.0 feet due to refusal.	6.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
7.5							
10.0							
12.5							
15.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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CONAM-1-01	TEST PIT TP-1	
JULY 2014	NWC OF TANNLER & BLAKENSHIP WEST LINN, OR	FIGURE A-1

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to moderately weathered, moderately to very intensely fractured, abundant shrub roots (2-inch-thick root zone).					
		without shrub roots at 1.5 feet					
2.5							
		grades to medium hard (R3); moderately to intensely weathered, moderately fractured at 3.0 feet					
		soft to medium hard (R2-R3), gray; moderately to intensely weathered, moderately fractured at 4.0 feet					
5.0		Exploration terminated at a depth of 5.0 feet due to refusal.	5.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
7.5							
10.0							
12.5							
15.0							

0 50 100

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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JULY 2014

TEST PIT TP-2

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-2

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		TOPSOIL, abundant shrub roots (12-inch-thick root zone).					
		Very soft to soft (R1-R2), brown-gray BASALT; decomposed to moderately weathered, moderately to very intensely fractured.	1.0				
2.5							
		soft to medium hard (R2-R3); moderately to intensely weathered, slightly to moderately fractured at 3.5 feet					
5.0		Exploration terminated at a depth of 5.0 feet due to refusal.	5.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
7.5							
10.0							
12.5							
15.0							

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EXCAVATION METHOD: trackhoe (see report text)

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JULY 2014

TEST PIT TP-3

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-3

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		TOPSOIL, abundant shrub roots (18-inch-thick root zone).					
		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, moderately to very intensely fractured.	1.5				
2.5							
5.0		gray-brown; decomposed at 5.0 feet					
		slightly to moderately fractured at 5.5 feet					
7.5							
					⊠		
		soft to medium hard (R2-R3) at 9.5 feet					
10.0		Exploration terminated at a depth of 10.0 feet due to refusal.	10.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
12.5							
15.0							

0 50 100

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EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-4

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-4

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		TOPSOIL, abundant shrub roots (12-inch-thick root zone).					
		Very soft to soft (R1-R2), brown BASALT; decomposed to intensely weathered, moderately to intensely fractured.	1.0				
2.5							
		soft to medium hard (R2-R3) at 3.0 feet					
5.0		extremely soft to very soft (R0-R1), gray-yellow; decomposed at 5.0 feet					
7.5		soft to medium hard (R2-R3) at 7.5 feet			☒		
		Exploration terminated at a depth of 8.0 feet due to refusal.	8.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
10.0							
12.5							
15.0						0 50 100	

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EXCAVATION METHOD: trackhoe (see report text)

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JULY 2014

TEST PIT TP-5

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-5

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, brown SILT with gravel (ML), trace organics (rootlets), shrub roots; moist (2-inch-thick root zone).					
		without shrub roots at 1.5 feet			☒		
2.5		Medium dense, brown, silty GRAVEL (GM); moist, fine to coarse and angular (decomposed basalt). with cobbles at 3.0 feet	2.5		☒		
5.0							
7.5		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	7.0				
10.0		very soft to medium hard (R1-R3); moderately to intensely weathered at 10.0 feet					
		Exploration terminated at a depth of 10.5 feet due to refusal.	10.5				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
12.5							
15.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-6

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-6

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, brown SILT with gravel (ML), trace organics (rootlets), abundant shrub roots; moist (4-inch-thick root zone).					
		Very soft to soft (R1-R2), brown-gray BASALT; decomposed to intensely weathered, moderately to very intensely fractured.	1.0				
2.5							
		medium hard to hard (R3-R4); moderately to intensely weathered at 4.0 feet					Slow groundwater seepage observed at 4.0 feet.
		Exploration terminated at a depth of 4.5 feet due to refusal.	4.5				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
5.0							
7.5							
10.0							
12.5							
15.0						0 50 100	

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EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-7

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-7

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Soft to medium stiff, brown SILT (ML), some clay, trace organics (rootlets); moist (4-inch-thick root zone).					Moderate caving observed at 1.5 feet.
2.5					⊠		
		Very soft to soft (R1-R2), brown and gray-yellow BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	3.5				
5.0		soft to medium hard (R2-R3); moderately to very intensely fractured at 5.0 feet					
7.5		medium hard (R3) at 7.0 feet					
		Exploration terminated at a depth of 9.5 feet due to refusal.	9.5				No groundwater seepage observed to the depth explored. Surface elevation was not measured at the time of exploration.
10.0							
12.5							
15.0						0 50 100	

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EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-8

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-8

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Soft to medium stiff, brown SILT with gravel (ML), trace organics (rootlets), abundant fine roots; moist (4-inch-thick root zone). without fine roots at 1.0 foot					
		Very soft to soft (R1-R2), brown and gray-black BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	1.5				
2.5		soft to medium hard (R2-R3); moderately to very intensely weathered, moderately to very intensely fractured at 3.5 feet					
		Exploration terminated at a depth of 4.0 feet due to refusal.	4.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
5.0							
7.5							
10.0							
12.5							
15.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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JULY 2014

TEST PIT TP-9

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-9

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Soft to medium stiff, brown SILT (ML), some clay, trace organics; moist (4-inch-thick root zone).					Minor caving observed at 1.0 foot.
		wood/roots at 2.0 feet					
2.5		medium stiff at 2.5 feet					
		Extremely soft to very soft (R0-R1), brown BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	3.5				
5.0							
		soft to medium hard (R2-R3); moderately to intensely weathered, moderately to intensely fractured at 6.5 feet					
7.5		Exploration terminated at a depth of 7.0 feet due to refusal.	7.0				No groundwater seepage observed to the depth explored. Surface elevation was not measured at the time of exploration.
10.0							
12.5							
15.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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JULY 2014

TEST PIT TP-10

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-10

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Blackberry cuttings (2.0 inches).	0.2				
		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, abundant roots; moist. without abundant roots at 1.0 foot medium stiff, brown, none to trace organics at 1.5 feet stiff at 2.0 feet					
2.5							
		brown-yellow at 4.0 feet					
5.0		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	5.0				
7.5							
		very soft to soft (R1-R2), gray; vuggy at 8.0 feet					
		moderately to intensely fractured at 9.0 feet					
10.0		soft to medium hard (R2-R3) at 10.0 feet					Slow to moderate groundwater seepage observed at 10.0 feet.
		Exploration terminated at a depth of 10.5 feet due to refusal.	10.5				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
12.5							
15.0						0 50 100	

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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JULY 2014

TEST PIT TP-11

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-11

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Blackberry cuttings (2.0 inches).					
	Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, abundant blackberry roots; moist. without abundant blackberry roots at 1.0 foot medium stiff, brown, trace organics at 1.5 feet	0.2				
2.5	stiff at 2.5 feet			☒		
	brown-yellow at 4.5 feet					
5.0	Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	5.0				
7.5	gray; slightly to moderately fractured, vuggy at 7.5 feet					
10.0						
	Exploration terminated at a depth of 10.5 feet due to refusal.	10.5				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
12.5						
15.0						

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

GEODESIGN INC
15575 SW Sequoia Parkway - Suite 100
Portland OR 97224
Off 503.968.8787 Fax 503.968.3068

CONAM-1-01

JULY 2014

TEST PIT TP-12

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-12

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Blackberry cuttings (2.0 inches).	0.2				
		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist. medium stiff, brown, trace organics, without blackberry roots at 1.0 foot					Minor caving observed at 1.0 foot.
2.5		Very soft to soft (R1-R2), gray-brown BASALT; decomposed to intensely weathered, moderately to very intensely fractured.	2.0				
5.0							
7.5		medium hard to hard (R3-R4); slightly to moderately weathered, moderately fractured at 7.0 feet	7.5				No groundwater seepage observed to the depth explored.
		Exploration terminated at a depth of 7.5 feet due to refusal.					Surface elevation was not measured at the time of exploration.
10.0							
12.5							
15.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc.

LOGGED BY: NAK

COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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JULY 2014

TEST PIT TP-13

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-13

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Blackberry cuttings (2.0 inches).					
		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist. medium stiff, brown, trace organics, without blackberry roots at 1.0 foot	0.2				
2.5							
		Very soft to soft (R1-R2), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	4.0				
5.0					☒		
7.5		Exploration terminated at a depth of 7.5 feet due to refusal.	7.5				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
10.0							
12.5							
15.0						0 50 100	

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-14

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-14

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Blackberry cuttings (2.0 inches).	0.2				
		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist - **FILL**. without blackberry roots at 1.0 foot medium stiff, with cobbles, trace gravel at 2.0 feet					
2.5							Bottle cap and wood debris at 3.0 feet.
		Medium stiff to stiff, brown SILT (MH), some clay, trace gravel; moist.	3.5		☒		
5.0							
7.5							
		Extremely soft to very soft (R0-R1), brown-yellow and gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	8.0				
10.0		very soft to soft (R1-R2); moderately to intensely weathered, moderately fractured at 10.5 feet soft to medium hard (R3-R5) at 11.5 feet					
		Exploration terminated at a depth of 12.0 feet due to refusal.	12.0				
12.5							No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
15.0						0 50 100	

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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CONAM-1-01

JULY 2014

TEST PIT TP-15

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-15

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Blackberry cuttings (2.0 inches).					
		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist. medium stiff, brown, trace organics, without blackberry roots at 1.0 foot stiff at 2.0 feet	0.2				
2.5							
5.0							
		Extremely soft to very soft (R0-R1), brown-yellow and gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	6.0				
7.5							
		soft to medium hard (R2-R3); moderately to intensely weathered, moderately to intensely fractured at 9.0 feet					
10.0		Exploration terminated at a depth of 9.5 feet due to refusal.	9.5				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
12.5							
15.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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CONAM-1-01

JULY 2014

TEST PIT TP-16

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-16

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Blackberry cuttings (2.0 inches).					
		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist. without blackberry roots at 1.0 foot	0.2				
2.5		medium stiff, brown-yellow, none to trace organics at 2.0 feet stiff at 2.5 feet					Slow groundwater seepage observed at 3.5 feet.
5.0		trace sand at 5.0 feet					
7.5		with sand at 7.0 feet					
10.0		soft to medium hard (R2-R3); moderately to intensely weathered, moderately to intensely fractured at 9.0 feet			☒		
		with cobbles, trace gravel at 11.0 feet					
12.5		Very soft to soft (R1-R2), brown-yellow and gray BASALT; decomposed to moderately weathered, moderately to intensely fractured.	12.5				
15.0		Exploration terminated at a depth of 13.5 feet due to refusal.	13.5				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: NAK COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

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CONAM-1-01

JULY 2014

TEST PIT TP-17

NWC OF TANNLER & BLAKENSHIP
WEST LINN, OR

FIGURE A-17

TEST PIT LOG - 1 PER PAGE CONAM-1-01-TP1_17.GPJ GEODESIGN.GDT PRINT DATE: 7/28/14:KT

APPENDIX D

APPENDIX D
REPORT LIMITATIONS AND IMPORTANT INFORMATION

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction Observation

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples
Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents
This geotechnical or environmental report should not be copied or duplicated unless in full, and even then only under prior written consent by Columbia West, as indicated in further detail in the following text section entitled Report Ownership. The recommendations, interpretations, and suggestions presented in this report are only understandable in context of reference to the whole report. Under no circumstances should the soil boring or test pit excavation logs, monitor well logs, or laboratory analytical reports be separated from the remainder of the report. The logs or reports should not be redrawn or summarized by other entities for inclusion in architectural or civil drawings, or other relevant applications.

Report Limitations for Contractors
Geotechnical or environmental reports, unless otherwise specifically noted, are not prepared for the purpose of developing cost estimates or bids by contractors. The extent of exploration or investigation conducted as part of this report is usually less than that necessary for contractor's needs. Contractors should be advised of these report limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this report, but should rely upon their own interpretations as to how subsurface conditions may affect cost, feasibility, accessibility and other components of the project work. If believed necessary or relevant, contractors should conduct additional exploratory investigation to obtain satisfactory data for the purposes of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface ground conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

Report Ownership
Columbia West retains the ownership and copyright property rights to this entire report and its contents, which may include, but may not be limited to, figures, text, logs, electronic media, drawings, laboratory reports, and appendices. This report was prepared solely for the client, and other relevant approved users or parties, and its distribution must be contingent upon prior express written consent by Columbia West. Furthermore, client or approved users may not use, lend, sell, copy, or distribute this document without express written consent by Columbia West.

Client does not own nor have rights to electronic media files that constitute this report, and under no circumstances should said electronic files be distributed or copied. Electronic media is susceptible to unauthorized manipulation or modification, and may not be reliable.

Consultant Responsibility

Geotechnical and environmental engineering and consulting is much less exact than other scientific or engineering disciplines, and relies heavily upon experience, judgment, interpretation, and opinion often based upon media (soils) that are variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical or environmental consultant. To reduce potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical and environmental reports often provide definitive statements or clauses defining and outlining consultant responsibility. The client is encouraged to read these statements carefully and request additional information from Columbia West if necessary.

Geotechnical ▪ Environmental ▪ Special Inspections
Columbia West Engineering, Inc

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January 27, 2026

MCRT Investments LLC
720 SW Washington Street, Suite 720
Portland, OR 97205

Attention: Chad Encinas

Re: Addendum 1
Onsite Infiltration
Modera West Linn
Tannler Drive and Blankenship Road
West Linn, Oregon
CWE Project: MCRT-1-01-1

INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) is pleased to submit this addendum to the geotechnical engineering report for the Modera West Linn project located in West Linn, Oregon.[1]

INFILTRATION SYSTEMS

As summarized in our report, our site explorations generally encountered root zone and topsoil underlain by zones of silt (colluvium). Also, prior explorations (by others) encountered localized zone of undocumented fill. Decomposed to weathered basalt was encountered below the topsoil, fill, and silt units.

Due to the presence of steep slopes at the site and subsurface conditions summarized above, we do not recommend that stormwater drainage be infiltrated on the site. Stormwater should be routed to an appropriate stormwater management system.

♦ ♦ ♦

[1] Columbia West 2025. *Report of Geotechnical Engineering Services; Modera West Linn; Tannler Drive and Blankenship Road; West Linn, Oregon,* dated September 16, 2025, CWE Project: MCRT-1-01-1.

We appreciate the opportunity to submit this addendum. Please do not hesitate to contact us if you have questions or require additional information.

Sincerely,

REGISTERED PROFESSIONAL
ENGINEER
84829PE
OREGON
November 10, 2015
NAJIB A. KALAS
EXPIRES: 06/30/27

Najib A. Kalas, PE
Principal Engineer

cc: Tim Urben, MCRT Investments LLC
Sam Rodriguez, MCRT Investments LLC
Ryan Mosher, Harper Houf Peterson Righellis, Inc

NAK
Document ID: MCRT-1-01-1-012726-geoa-1

APPENDIX H

OPERATIONS AND MAINTENANCE MANUAL

Stormwater Planters

Maintenance Indicator	Corrective Action
Structural components must be operated and maintained in accordance with the design specifications.	
Clogged inlets or outlets	Remove sediment and debris from catch basins, underdrains, curb inlets, and drainpipes.
Broken inlets or outlets	Repair/replace broken downspouts, curb cuts, standpipes, and screens.
Damaged liners and walls (for filtration planters)	Extend and secure liner to planter walls above the high-water mark. The facility must be watertight to protect abutting foundations from moisture damage.
Cracked or exposed drainpipes	Repair or seal cracks. Replace when repair is insufficient. Cover with 6 inches of growing medium to prevent freeze/thaw and UV damage.
Vegetation must cover at least 90% of the facility at maturity.	
Dead or stressed vegetation	Replant per original planting plan, or substitute from the plant list referenced in **Appendix E**. Irrigate and mulch as needed; prune tall, dry grasses, and remove clippings.
Tall grass and vegetation	Prune to allow for sight lines and foot traffic. Prune to ensure inlets and outlets freely convey stormwater into and/or out of the facility.
Weeds	Manually remove weeds.
Growing medium must sustain healthy plant cover and infiltrate within 48 hours.	
Gullies, erosion, or exposed soils	Fill in and lightly compact areas of erosion with City-approved soil mix (see **Appendix D**) and replant according to planting plan or substitute from the plant list referenced in **Appendix E**.
Scouring at the inlet(s)	Ensure splash blocks or inlet gravel/rock are adequate.
Ponding	Rake, till, or amend soil surface with City-approved soil mix to restore infiltration rate. Remove and replace sediment at entrances.

Annual Maintenance Schedule	
Summer	Make structural repairs; clean gutters and downspouts; remove any build-up of weeds or organic debris.
Fall	Replant exposed soil and replace dead plants. Remove sediment and plant debris.
Winter	Clear gutters and downspouts.
Spring	Remove sediment and plant debris. Replant exposed soil and replace dead plants.
All seasons	Weed, as necessary.

Maintenance Records: All facility operators are required to keep an inspection and maintenance log. Record date, description, and contractor (if applicable) for all repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make them available at the request of the City inspector.

Fertilizers/Pesticides/Herbicides: Their use is strongly discouraged because of the potential for negative water quality impacts to downstream systems. If pesticides or herbicides are required, use the services of a licensed applicator and products approved for aquatic use.

Access: Maintain ingress/egress per design standards.

Infiltration/Flow Control: All facilities must drain within 48 hours. Record time/date, weather, and conditions when ponding occurs.

Pollution Prevention: All sites must implement BMPs to prevent contamination of stormwater. Call 503-722-5500 during work hours, and 503-635-0238 after hours to report spills. Never wash spills into a stormwater management facility. If contamination occurs, document the circumstances and the corrective actions taken; include the time/date, weather, and site conditions.

Vectors (Mosquitoes and Rats): Stormwater management facilities must not harbor mosquito larvae or rodents that pose a threat to public health or that undermine facility structures. Record the time/date, weather, and site conditions if vector activity is observed and record when vector abatement started and ended.

CONTECH
ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit and the unit's role, relative to detention or retention facilities onsite.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to whether or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered).

Please note Stormwater Management StormFilter devices installed downstream of, or integrated within, a stormwater storage facility typically have different operational parameters (i.e. draindown time). In these cases, the inspector must understand the relationship between the retention/detention facility and the treatment system by evaluating site specific civil engineering plans, or contacting the engineer of record, and make adjustments to the below guidance as necessary. Sediment deposition depths and patterns within the StormFilter are likely to be quite different compared to systems without upstream storage and therefore shouldn't be used exclusively to evaluate a need for maintenance.

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. While not required in all cases, inspection of the media within the cartridge may provide valuable additional information.
   b. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Inspection Report

Date: ____________________ Personnel: ____________________

Location: ____________________ System Size: ____________________ Months in Service: ____________________

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: __________

Sediment Thickness in Forebay: ____________________ Date: ____________________

Sediment Depth on Vault Floor: ____________________

Sediment Depth on Cartridge Top(s): ____________________

Structural Damage: ____________________

Estimated Flow from Drainage Pipes (if available): ____________________

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: ____________________

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: ____________________

☐ Minor Structural Repairs: ____________________

☐ Drainage Area Report ____________________

Excessive Oil Loading: Yes ☐ No ☐ Source: ____________________

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ____________________

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ____________________

Items Needing Further Work: ____________________

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

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Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: ______________________ Personnel: ______________________________

Location: ______________________ System Size: ______________________________

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other: __________

List Safety Procedures and Equipment Used: ______________________________

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____

System Observations

Months in Service: ______________________________

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): ______________________________

Sediment Depth on Vault Floor: ______________________________

Sediment Depth on Cartridge Top(s): ______________________________

Structural Damage: ______________________________

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: ______________________________

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ______________________________

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ______________________________

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: ______________________________

Replace Cartridges: Yes ☐ No ☐ Details: ______________________________

Sediment Removed: Yes ☐ No ☐ Details: ______________________________

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: ______________________________

Residuals (debris, sediment) Disposal Methods: ______________________________

Notes:

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STORMWATER STORAGE SYSTEM

OPERATIONS AND MAINTENANCE MANUAL

Green Stormwater Infrastructure Solutions

TABLE OF CONTENTS

DISCLAIMER

Read the following information before inspecting, cleaning, or performing maintenance on this Stormwater Treatment Device. This manual is intended to explain the specifics of the maintenance on R-Tank Stormwater Storage Systems.

It is the responsibility of all personnel to familiarize themselves with, understand and comply with all applicable local, state, and federal laws. All information in this manual is current at the time of printing but are subject to change based on the development of new processes and procedures. Ferguson Enterprises assumes no responsibility and is not accountable for any injuries, fines, penalties, or losses that occur involving any procedure in this manual or other actions taken. The R-Tank Stormwater Storage System performance is based on the procedures being followed in this manual. Non-Compliance with the outlined measures will be the responsibility of the owner.

GENERAL INFORMATION

Your R-Tank System has been designed to function in conjunction with the engineered drainage system on your site, the existing municipal infrastructure, and/or the existing soils and geography of the receiving watershed. Unless your site included certain unique and rare features, the operation of your R-Tank System will be driven by naturally occurring systems and will function autonomously. However, upholding a proper schedule of Inspection & Maintenance is critical to ensuring continued functionality and optimum performance of the system.

INSPECTION INFORMATION

During construction, the system shall be protected from sediment laden runoff and only activated once the site has been fully stabilized.

Both the R-Tank and all stormwater pre-treatment features incorporated into your site must be inspected regularly. Inspections should be done every six months for the first year of operation, and at least yearly thereafter. Inspections may be required more frequently for pre-treatment systems. You should refer to the manufacturer requirements for the proper inspection schedule.

With the right equipment most inspections and measurements can be accomplished from the surface without physically entering any confined spaces. If your inspection does require confined space entry, you must follow all local, regional, and OSHA requirements.

All maintenance features of your system can be accessed through a covering at the surface. With the lid removed, you can visually inspect each component to identify sediment, trash, and other contaminants within the structure. Check your construction plans to identify the maintenance features engineered into your R-Tank system, which may include:

Upstream Pipes, Inlets, and Manholes: Working from the structures adjacent the R-Tank toward those farther away, check for debris and sediment in both the structures and the pipes. Be sure to include all structures that contain pre- treatment systems. Some structures may include a sump.

Maintenance Ports / Inspection Ports: Maintenance/inspection ports are located near the inlet and outlet connections, treatment rows, and throughout the system. These should be used to check for sediment and typically allow access for backflushing and cleaning.

Treatment Row: On installations in 2018 or later, inlet pipes may connect to a row of modules with 12” diameter access holes running horizontally through the module that can be jet vacuumed. Check these rows for accumulation of sediment and debris.

All observations and measurements should be recorded on an Inspection Log kept on file. We have included a form you can use at the end of this guide.

INSPECTION CHECKLIST

Site Name:		Company:	
Location:		Contact:	
City and State:		Phone:	
System Owner:		Email:	

Inspection Description	Frequency	Observations / Notes	Initials
Pretreatment Systems	Quarterly		
Connections	Bi-Annually		
Inspection Ports	Bi-Annually		
Accumulation of Sediment or Debris	Bi-Annually		
Upslope Erosion	Quarterly		
Accidental or Illicit Spillage	Quarterly		

Maintenance Items	Required Maintenance Activities	Initials
Pretreatment Systems		
Connections		
Inspection Ports		
Accumulation of Sediment or Debris		
Upslope Erosion		
Accidental or Illicit Spillage		

SYSTEM MAINTENANCE

For modules taller than 40” the R-Tank Stormwater Storage Systems should be back-flushed once sediment accumulation has reached 6”. For modules less than 40” tall, perform maintenance when sediment depths are greater than 15% of the total system height. If your system includes a Treatment Row with linear access through the modules from the inlet pipe, backflush this area when sediment depths reach 6”.

BEFORE ANY MAINTENANCE IS PERFORMED ON YOUR SYSTEM - PLUG THE OUTLET PIPE TO PREVENT CONTAMINATION OF THE DOWNSTREAM SYSTEMS.

Maintenance During Construction

Installed R-Tank Stormwater Storage Systems should be properly protected post installation, but before the System is accepted by owners in the following manner:

- **Vehicular Traffic:** Protect system from heavy construction equipment loads by using smaller vehicles, low ground pressure tracked equipment when possible, or protective measures such as steel plates to spread the load experienced by the system.
- **Sediment and Debris:** Use proper erosion control Best Management Practices to prevent sediment and debris from reaching the system.
- **Remove Sediment and Debris, as Needed:** If upslope practices fail to prevent sediment laden runoff from entering the upstream inlets, pipes, and system, sediment removal should be performed using jet-vac equipment.

Maintenance After Construction

Site specific conditions (land use, climate, tree cover, slopes, construction activities, etc.) along with data from regular inspections will determine how frequently the system must be cleaned. At a minimum, vacuum cleaning should occur every 1 to 2 years. Routine maintenance, such as pre-treatment inlet cleanout should occur every 3 to 6 months.

- Begin by cleaning all upstream structures, pipes, and pre-treatment systems containing sediment and/ or debris. If your system includes a Treatment Row, this portion of the system should be cleaned with traditional jet-vac equipment. Add a centralizer to the jet for easiest access through the modules.
- Complete initial debris removal by vacuuming debris up the inspection port locations, while using the jetting water to push debris to the hose. For finer debris, back-flush the R-Tank system. To perform this, water is pumped into the system through the inspection ports as rapidly as possible. The turbulent action of the water moving through the R-Tank will suspend sediments which may then be pumped out. If your system includes an outlet structure, this will be the ideal location to pump contaminated water out of the system. However, removal of back-flush water may be accomplished through the inspection ports, as well.
- For systems with large footprints that would require extensive volumes of water to properly flush the system, you should consider performing your maintenance within 24 hours of a rain event. Stormwater entering the system will aid in the suspension of sediments and reduce the volume of water required to properly flush the system.

INSPECTION AND MAINTENANCE COST ESTIMATE WORKSHEET

Project Name:		Engineer:	
Location:		City / State:	
Owner:		Contact:	
Phone:		Email:	

Life Expectancy (Yrs.) =	

Inspection Description	Frequency / Year	Total Services*	Cost per Service	Total Cost**
Pretreatment Systems	4		$	$
Connections	2		$	$
Inspection Ports	2		$	$
Accumulation of Sediment or Debris	2		$	$
Upslope Erosion	4		$	$
Accidental or Illicit Spillage	4		$	$

Maintenance Items	Frequency / Year	Total Services*	Cost per Service	Total Cost**
Pretreatment Systems			$	$
Connections			$	$
Inspection Ports			$	$
Accumulation of Sediment or Debris			$	$
Upslope Erosion			$	$
Accidental or Illicit Spillage			$	$
System Vacuuming			$	$
Total Costs = Inspection Costs + Maintenance Costs =				$
Estimated Annual Operating Expenses = Total Costs / Years of Service =				$

** Total Services = Frequency of Services / Yr. multiplied by Life Expectancy*
*** Total Cost = Total Services multiplied by Cost per Service*