Preliminary Storm Drainage Report

The Haworth

Newberg, Oregon

Applicant:
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Portland, Oregon 97223
503.793.3299

Engineer:
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Newberg Case File No:

REGISTERED PROFESSIONAL ENGINEER
74669PE
PRELIMINARY
OREGON
JULY 13, 2004
LUKE R. LAPPIN
VALID THROUGH 12-31-22

Date: November 7, 2022
Prepared by: Luke Lappin, PE
PDG Job No. 121-029

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TECHNICAL APPENDIX

1.0 INTRODUCTION

This report represents the **preliminary** storm drainage and stormwater analysis for The Haworth apartment project. The basis of this report is to comply with City of Newberg, and the State of Oregon's regulations and engineering standards as well as the latest edition of the Oregon Plumbing Specialty Code (OSPC). Compiled in this report are the design criteria for the site, the hydrologic methodology, and the **preliminary** drainage analysis.

2.0 SITE DESCRIPTION AND LOCATION

The proposed development is a 28-unit apartment building with associated parking and utilities. The property is identified as tax lot 00800 of Tax Map 3S216CB and is approximately 0.82 acres. The site is not currently addressed and is located at the southwest corner of the intersection of E. Haworth Avenue and N. Springbrook Road. The property is zoned C2 – Community Commercial.

3.0 EXISTING CONDITIONS

The site is currently vacant with grass covering the entire parcel. There are no trees on the property with a large arborvitae hedge bordering the west boundary and three large trees along the property line to the south. No wetlands or floodplains have been identified on site.

There is a 15-foot public storm drainage easement located along the northern boundary and another 15-foot public storm drainage easement crossing at an angle from the northeast corner to the mid-point on the southern boundary. A third triangular easement for slope and drainage is located at the northeast corner of the property.

The site has frontage along two public streets, E. Haworth Avenue and N. Springbrook Road. Existing storm, sanitary and water systems surround the property and are available for use to serve the development.

3.1 Site Topography

The property generally slopes from west to east. The high point of the site is along the southwest boundary at an approximate elevation of 208.55 feet, with a relative low point along the east property line near N Springbrook Road at an elevation of 203 feet. Existing grades range between 1 and 5%.

The adjacent properties to the east, south and west are all zoned C-2 while across E Haworth Avenue to the north is the Azalea Gardens Mobile Manor designated R-2. East of the site is the Springbrook Plaza shopping center.

3.2 Soil Type

The predominant soil types found on site are Verboort silt clay loam (2027A) and Woodburn silt loam (2310A) with a corresponding hydrologic soil group (HSG) designation 'D' and 'C' respectively, as shown on the attached Natural Resources Conservation Service (NRCS) soil survey for Yamhill County.

Table 3-2: Hydrologic Soil Group Ratings		
NRCS Map Unit Symbol	**NRCS Map Unit Name**	**Hydrologic Soil Group Rating**
2027A	Verboort silt clay loam	D
2310A	Woodburn silt loam	C

3.3 Runoff Curve Numbers

Predeveloped pervious areas will use a composite Runoff Curve Number (RCN) of 78 corresponding to "Open Space" cover type (HSG designation 'C') in good condition. Developed pervious areas will use a composite Runoff Curve Number (RCN) of 83.2 corresponding to "Open Space" cover type (HSG designation 'C') in fair condition. A runoff curve number of 98 will be used for all predeveloped and developed impervious areas (refer to the *SCS Runoff Curve Numbers* Exhibit).

Table 3.3 – Runoff Curve Numbers		
Land Description	**Existing RCN**	**Proposed RCN**
Open Space, Good Condition	78	---
Open Space, Fair Condition	---	83.2
Impervious	98	98

4.0 PROPOSED IMPROVEMENTS

We will be constructing impervious surfaces as a result of the proposed apartment building, parking lot and sidewalks. Private utilities will be extended to the site for use by the development.

On-site impervious areas will be treated in proprietary stormfilter cartridge manholes while an underground Stormtech detention chamber system will provide detention for the site meeting boundary, site, slope, building, and structure setbacks.

4.1 Hydrology/Hydraulic Methodology

Using the Santa Barbara Urban Hydrograph (SBUH) method based on a Type 1A rainfall distribution, the site has been analyzed to determine the proposed peak runoff rates for half the 2, 2, 5, 10, and 25-year 24-hour storm event. The SBUH method uses runoff curve numbers in conjunction with the property's hydrologic soil group to model the site's permeability. Stormwater analysis and facility design was provided using the "HydroCAD" 10.00 Stormwater modeling software.

A predeveloped time of concentration of 16.45 minutes and a developed time of concentration of 5.0 minutes were calculated using the methodology outlined in the TR-55 technical manual *(refer to the Time of Concentration Calculations and Exhibits)*.

Rainfall depths for all storm events used in the calculations and design of the proposed storm drainage system are found in latest edition of the City of Newberg Public Works Design and Construction Standards and shown below.

Table 4-1: 24-Hour Rainfall Depths (City of Newberg)

Recurrence Interval, Years	2	5	10	25	100
24-Hour Depths, Inches	2.5	3.0	3.5	4.0	4.5

4.2 Water Quality

As required by City of Newberg, any new development that creates more than 2,877 square feet of impervious area will be required to provide water quality and quantity treatment. Stormwater management will be provided in accordance with the *2015 Public Works Design and Construction Standards, Section 4*.

As per *Section 4.6.1.III – Impervious Surface Area*, for all developments other than single family and duplex, including row houses and condominiums, the sizing of stormwater quality facilities shall be based on the net impervious area created by the development, including structures, roads, and other impervious areas.

The water quality storm defines both the volume and rate of runoff. Stormwater quality only facilities shall be designed for a dry weather storm event totaling 1.0 inches of precipitation falling in 24 hours with an average storm return period of 96. See *Appendix 'D' – Stormfilter Manhole Detail* for water quality storm flow rate.

On-site runoff will be treated by two proprietary 48" diameter stormfilter manholes (refer *to Appendix 'D' – Stormfilter Manhole Detail)*. These facilities will provide treatment for all contributing onsite pavement impervious surfaces as outlined in the City of Newberg's *"Public Works Design and Construction Standard's," 2015*.

Stormwater from the parking lot will be collected in trapped catch basins for pretreatment, pollution reduction and spill control prior to being conveyed into the proposed stormfilter manholes.

Private facilities shall be maintained by the owner with a maintenance agreement recorded with Yamhill County.

Existing and proposed impervious area have been calculated for the development and are listed in the *Impervious Area Calculation* spreadsheet. The proposed project will create approximately 24,472 sq. ft of new impervious surface. There is no existing impervious area.

4.3 Water Quantity

Stormwater quantity facilities shall be designed to capture runoff so the post-development runoff rates from the site do not exceed the predevelopment runoff rates from the site, based on 24-hour storm events ranging from the ½ of the 2-year return storm to the 25-year return storm. Specifically, the ½ of the 2, 2, 10, and 25-year post-development runoff rates will not exceed their respective ½ of the 2, 2, 10, and 25-year pre-development runoff rates.

Water quantity control (detention) will be managed onsite meeting the requirements of the City of Newberg's *"Public Works Design and Construction Standard's," 2015 – Section 4.7*.

Underground detention will be provided in the form of manufactured corrugated plastic chambers (StormTech ADS SC-740). Runoff from the site will flow into seven rows of seven chambers located underneath the parking lot. An "isolator" row will provide enhanced suspended solids and pollutant removal while allowing for maintenance access and cleaning. 6 inches of drainage rock will be placed below the chambers with 6 inches of rock above to provide the required volume.

A 30% void spacing in the fill material has been assumed for design purposes.

During the 25-year storm event, the water level in the underground detention facility will rise to an elevation approximately eight inches below the top of the chambers. The extra capacity in the system will account for sedimentation over the life of the project.

In the event the facility fails, stormwater overflow will be directed out of the trapped catch basin nearest the detention chambers where it will overtop the curb and sheet flow out to N. Springbrook Street and into the public storm system.

A flow control manhole with two orifices will attenuate the post-developed peak runoff for the 2, 10, and 25-year storm events to the respective ½ of the 2, 2, 10, and 25-year

predeveloped peak flows for the site. Orifice "A" will be sized to attenuate the 2-year storm, while Orifice "B" will be set above the 2-year storm elevation to attenuate larger storms. The top of the baffle wall will be set at an elevation to provide emergency overflow for the 100-year storm. The underground detention facility will have a total storage volume of 2,538 cubic feet. Confirmation of the chamber sizing is verified by the HydroCAD software calculations shown in *Appendix 'B' – Detention Chamber Sizing Calculations*.

Table 4.3 – Underground Detention			
Storm Event (yr)	**Pre-Developed (cfs)**	**Developed (cfs)**	**Released Outflow (cfs)**
½-2	0.045	0.17	0.04
2	0.09	0.40	0.09
5	0.16	0.50	0.16
10	0.22	0.59	0.22
25	0.30	0.69	0.30

4.4 Conveyance

The conveyance system for the site consists of an underground pipe system, underground detention facility, roof drains, trapped catch basins and filtered manholes. Stormwater from the project will be conveyed to an existing 24" storm system located in a public easement adjacent to E. Haworth Avenue. The existing storm main continues east to N. Springbrook Road where it connects to an existing 42" storm pipe that runs southwest diagonally through the subject site.

As per the requirements of the City of Newberg, the drainage system will be designed to convey the 25-year storm event and comply with the requirements of the Uniform Plumbing Code.

The outflow pipe connecting the underground detention facility to the existing storm main in E Haworth Avenue will be 12 inches at a slope of 0.010 ft/ft. All storm pipes conveying runoff into the detention facility will be 6, 8, and 10 inches, with a minimum slope of 0.010 ft/ft. Using a Manning's 'n' value of 0.013, a 6", 8", and 10" pipe at a slope of 0.010 ft./ft. has sufficient capacity to convey the 25-year storm event for the entire site (refer to the *Stormwater Conveyance Calculations*).

5.0 DOWNSTREAM ANALYSIS

Runoff from the development is ultimately discharged into an existing 42-inch storm main that runs through the middle of the development, past the adjacent property to the south

and across Hwy 99. Approximately 695 feet downstream of the subject site, runoff is discharged into an existing regional facility (wetlands) west of the Fred Meyer shopping center.

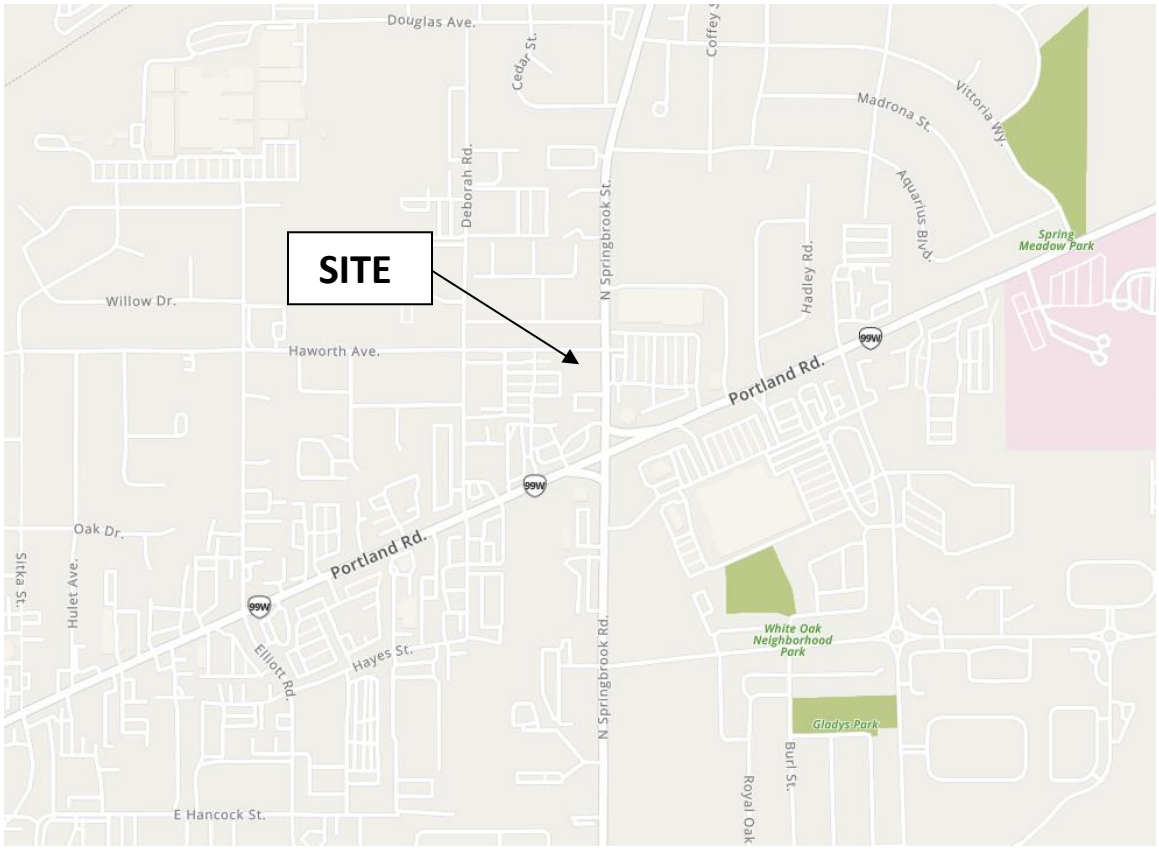
Per City of Newberg *"Public Works Design and Construction Standard's," 2015 – Section 4.5.IV.c – Downstream Analysis*, when the downstream analysis does not continue for at least one-quarter (1/4) mile, the design engineer shall provide a stamped certification of investigation that states the design Engineer has visually investigated the downstream system for at least one-quarter (1/4) mile downstream and is aware of no observable downstream impacts to the conveyance system.

No downstream restrictions were found between our site and the existing wetland facility. Furthermore, detention is provided on site and will not increase peak runoff nor exacerbate any potential downstream restrictions.

6.0 CONCLUSION

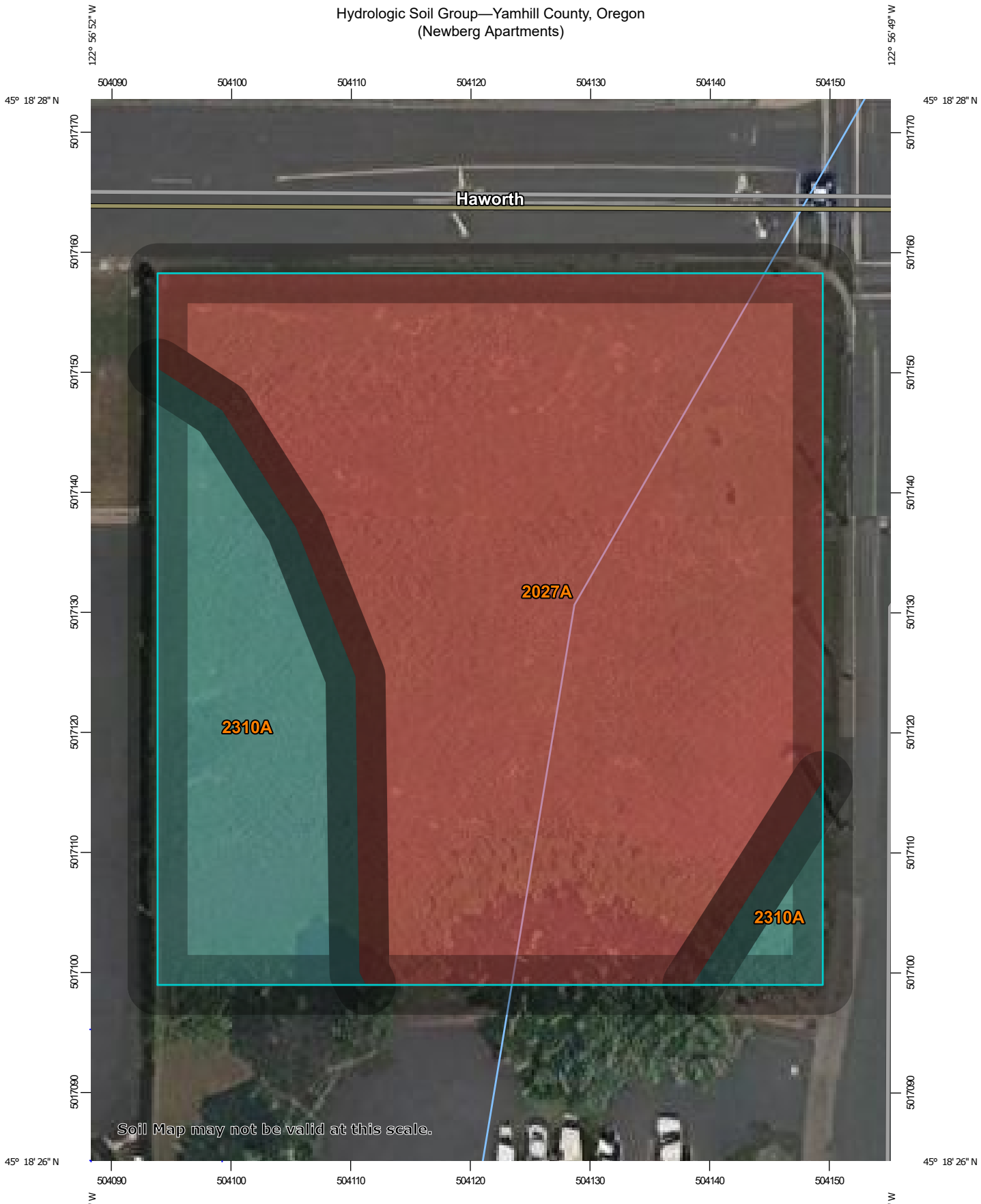
Based on the supporting stormwater calculations and attached analysis, it is the opinion of Pioneer Design Group that the development of The Haworth Apartments development project will not adversely affect the existing downstream drainage system or adjacent property owners. We have provided water quality and quantity treatment with the private proprietary stormfilter manholes and underground detention chambers. Therefore, all the requirements associated with City of Newberg's *Design and Construction Standards, 2015* have been met for this project.

7.0 VICINITY MAP



ENGINEERING CALCULATIONS AND SPREADSHEETS

Hydrologic Soil Group—Yamhill County, Oregon
(Newberg Apartments)



Map Scale: 1:431 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

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 Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: Yamhill County, Oregon
Survey Area Data: Version 10, Oct 27, 2021

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

Date(s) aerial images were photographed: Aug 19, 2015—Sep 13, 2016

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
2027A	Verboort silty clay loam, 0 to 3 percent slopes	D	0.6	76.1%
2310A	Woodburn silt loam, 0 to 3 percent slopes	C	0.2	23.9%
Totals for Area of Interest			**0.8**	**100.0%**

Description

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

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

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

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

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

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

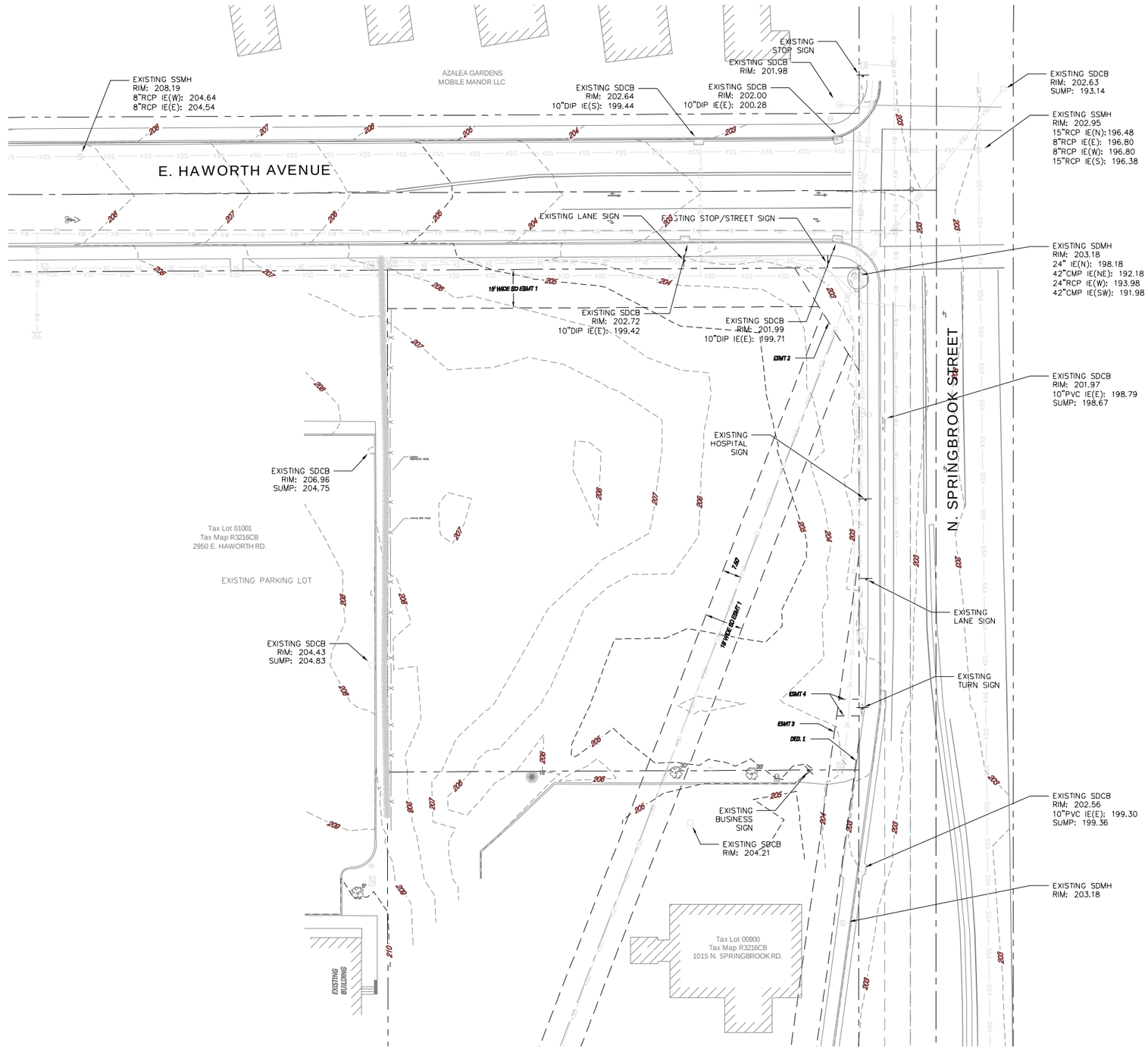
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



LEGEND

- RIGHT-OF-WAY LINE
- BOUNDARY LINE
- EXISTING LOT LINE
- CENTER LINE
- STORM DRAINAGE LINE
- SANITARY SEWER LINE
- WATER LINE
- GAS LINE
- COMMUNICATION LINE
- UNDERGROUND POWER LINE
- OVERHEAD WIRE
- WOOD FENCE (AS NOTED)
- EXISTING 2' CONTOUR
- EXISTING 10' CONTOUR
- CONIFEROUS TREE (DBH)
- DECIDUOUS TREE (DBH)
- EXISTING TREES TO BE REMOVED
- EXISTING CONCRETE
- EXISTING ASPHALT PAVEMENT
- EXISTING BUILDING
- CATCH BASIN/DRAIN INLET
- STORM MANHOLE
- SANITARY MANHOLE
- WATER VALVE
- FIRE HYDRANT ASSEMBLY
- WATER METER
- GAS VALVE
- GAS METER
- STREET SIGN
- MAILBOX
- ELECTRIC PEDESTAL
- ELECTRIC VAULT
- TELECOMMUNICATION VAULT
- TELECOMMUNICATION PEDESTAL
- UTILITY VAULT
- UTILITY PEDESTAL
- POWER POLE
- GUY WIRE
- -1.0% EXISTING SLOPE DIRECTION

EASEMENT AND DEDICATION LEGEND

ESMT. 1 15' WIDE PUBLIC STORM SEWER EASEMENTS PER PARTITION PLAT NO. 97-5

ESMT. 2 SLOPE AND DRAINAGE FACILITY EASEMENT PER FILM VOL 146, PG 430

ESMT. 3 EASEMENT AS DESCRIBED BY PARCEL 2 OF RECORD DOCUMENT #200015895, BEING A PERMANENT EASEMENT FOR SLOPES, WATER, GAS, ELECTRIC AND COMMUNICATION SERVICE LINES, FIXTURES AND FACILITIES TO ODOT.

ESMT. 4 EASEMENT AS DESCRIBED BY PARCEL 3 OF RECORD DOCUMENT #200015895, BEING A PERMANENT EASEMENT FOR SIGN TO ODOT

DED. 1 DEDICATION TO ODOT AS DESCRIBED BY PARCEL 1 OF RECORD DOCUMENT #200015895

SCALE
20 0 10 20
1 INCH = 20 FEET

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PRELIMINARY

EXISTING CONDITIONS AND DEMOLITION PLAN

THE HAWORTH APPARTMENTS
NEWBERG, OREGON

	Date	By
Designed by	11/2022	LBL
Drawn by	11/2022	LBL
Reviewed by	11/2022	MLS
Project No. 121-029	REF.	
Horiz. Scale:		
Vert. Scale:		

No.	Date	Revision	By

Project
NEWBERG APPARTMENTS
No.
121-029
Type
PLANNING
Sheet
P2.0

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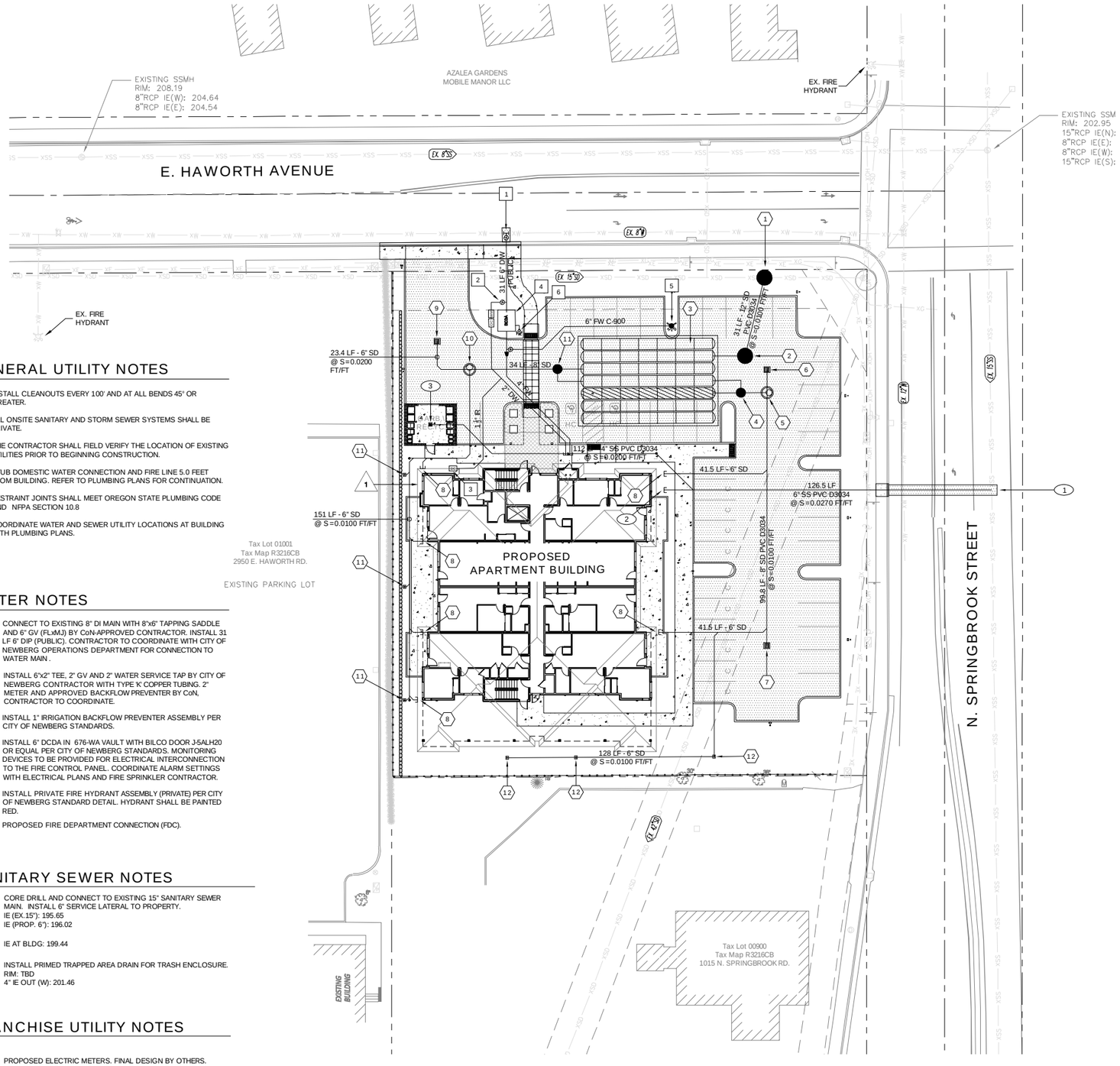

GENERAL UTILITY NOTES

1. INSTALL CLEANOUTS EVERY 100' AND AT ALL BENDS 45° OR GREATER.
2. ALL ONSITE SANITARY AND STORM SEWER SYSTEMS SHALL BE PRIVATE.
3. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF EXISTING UTILITIES PRIOR TO BEGINNING CONSTRUCTION.
4. STUB DOMESTIC WATER CONNECTION AND FIRE LINE 5.0 FEET FROM BUILDING. REFER TO PLUMBING PLANS FOR CONTINUATION.
5. RESTRAINT JOINTS SHALL MEET OREGON STATE PLUMBING CODE AND NFPA SECTION 10.8
6. COORDINATE WATER AND SEWER UTILITY LOCATIONS AT BUILDING WITH PLUMBING PLANS.

WATER NOTES

1. CONNECT TO EXISTING 8" DI MAIN WITH 8"x6" TAPPING SADDLE AND 6" GV (FLxMJ) BY CoN-APPROVED CONTRACTOR. INSTALL 31 LF 6" DIP (PUBLIC). CONTRACTOR TO COORDINATE WITH CITY OF NEWBERG OPERATIONS DEPARTMENT FOR CONNECTION TO WATER MAIN .
2. INSTALL 6"x2" TEE, 2" GV AND 2" WATER SERVICE TAP BY CITY OF NEWBERG CONTRACTOR WITH TYPE 'K' COPPER TUBING. 2" METER AND APPROVED BACKFLOW PREVENTER BY CoN, CONTRACTOR TO COORDINATE.
3. INSTALL 1" IRRIGATION BACKFLOW PREVENTER ASSEMBLY PER CITY OF NEWBERG STANDARDS.
4. INSTALL 6" DCDA IN 676-WA VAULT WITH BILCO DOOR J-5ALH20 OR EQUAL PER CITY OF NEWBERG STANDARDS. MONITORING DEVICES TO BE PROVIDED FOR ELECTRICAL INTERCONNECTION TO THE FIRE CONTROL PANEL. COORDINATE ALARM SETTINGS WITH ELECTRICAL PLANS AND FIRE SPRINKLER CONTRACTOR.
5. INSTALL PRIVATE FIRE HYDRANT ASSEMBLY (PRIVATE) PER CITY OF NEWBERG STANDARD DETAIL. HYDRANT SHALL BE PAINTED RED.
6. PROPOSED FIRE DEPARTMENT CONNECTION (FDC).

SANITARY SEWER NOTES

1. CORE DRILL AND CONNECT TO EXISTING 15" SANITARY SEWER MAIN. INSTALL 6" SERVICE LATERAL TO PROPERTY.
   IE (EX.15"): 195.65
   IE (PROP. 6"): 196.02
2. IE AT BLDG: 199.44
3. INSTALL PRIMED TRAPPED AREA DRAIN FOR TRASH ENCLOSURE.
   RIM: TBD
   4" IE OUT (W): 201.46

FRANCHISE UTILITY NOTES

1. PROPOSED ELECTRIC METERS. FINAL DESIGN BY OTHERS.

LEGEND

- PROPOSED DOMESTIC WATER LINE
- PROPOSED FIRE SERVICE LINE
- PROPOSED DOUBLE CHECK DETECTOR ASSEMBLY
- PROPOSED CLEANOUT
- PROPOSED TRAPPED CATCH BASIN
- PROPOSED LANDSCAPE DRAIN
- PROPOSED SANITARY SEWER LINE
- PROPOSED STORM DRAIN LINE
- PROPOSED FIRE HYDRANT
- PROPOSED FIRE DEPARTMENT CONNECTION (FDC)
- PROPOSED WATER AND IRRIGATION METER
- PROPOSED DOUBLE CHECK ASSEMBLY
- PROPOSED DOUBLE CHECK DETECTOR ASSEMBLY
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORMFILTER MANHOLE
- PROPOSED UNDERGROUND DETENTION CHAMBERS

STORM SEWER NOTES

1. INSTALL 60" Ø MANHOLE OVER EXISTING 24" STORM SEWER LINE.
   RIM = 203.87
   EX. 24" IE IN (E) = 193.85
   12" IE IN (SW) = 194.65
   EX. 241" IE OUT (W) = 193.65
2. INSTALL 60" FLOW CONTROL MANHOLE.
   RIM = TBD
   12" IE IN (W) = 194.96
   12" IE OUT (NE) = 194.96
3. 7 ROWS OF 7 UNDERGROUND DETENTION CHAMBERS
   (STORMTECH ADS SC-740)
   6" ROCK BASE, 6" ROCK COVER
   ROCK BOTTOM ELEV = 196.58
   CHAMBER BOTTOM ELEV = 197.08
4. INSTALL 30" Ø NYLOPLAST DRAIN BASIN
   (STANDARD AASHTO H-20 GRATE)
   INSTALL 11 LF 24" ACCESS PIPE WITH 10" MANIFOLD
   RIM = TBD
   10" IE IN (E) = 198.35
   10" IE OUT (N) = 198.35
   24" IE OUT (W) = 197.18
5. CONSTRUCT 48"Ø WATER QUALITY STORMFILTER MANHOLE (SFMH-1).
   (3-18" CARTRIDGES)
   RIM:TBD
   6" IE IN (N): 200.75
   8" IE IN (S): 200.75
   10" IE OUT (W): 198.45
6. CONSTRUCT TRAPPED CATCH BASIN
   INSTALL 8 LF 6" PVC D3034
   RIM: 204.06
   6" IE OUT (S): 200.56
7. CONSTRUCT TRAPPED CATCH BASIN
   INSTALL 180 LF 8" PVC D3034
   RIM: 204.63
   8" IE OUT (N): 201.75
8. CONNECT TO BUILDING ROOF DRAIN WITH 6" SD AT 2.0% MIN.
9. CONSTRUCT TRAPPED CATCH BASIN
   INSTALL 23.4 LF 6" PVC D3034
   RIM: 205.02
   6" IE OUT (S): 201.63
10. CONSTRUCT 48"Ø WATER QUALITY STORMFILTER MANHOLE (SFMH-2).
    (3-18" CARTRIDGES)
    RIM:TBD
    6" IE IN (W): 201.16
    6" IE IN (S): 201.16
    10" IE OUT (E): 198.86
11. INSTALL 30" Ø NYLOPLAST DRAIN BASIN
    (STANDARD AASHTO H-20 GRATE)
    INSTALL 11 LF 24" ACCESS PIPE WITH 10" MANIFOLD
    RIM = TBD
    8" IE IN (W) = 198.52
    10" IE OUT (S) = 198.35
    24" IE OUT (E) = 197.18
12. CONSTRUCT 12" SQ. LANDSCAPE AREA DRAIN WITH ATRIUM GRATE (ADS PART NOS. 1200, 1290, AND 1242 OR EQUAL).
13. CONSTRUCT 12" SQ. LANDSCAPE AREA DRAIN WITH ATRIUM GRATE (ADS PART NOS. 1200, 1290, AND 1242 OR EQUAL).

SCALE
20 0 10 20
1 INCH = 20 FEET

215
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PRELIMINARY

PRELIMINARY COMPOSITE UTILITY PLAN

THE HAWORTH APPARTMENTS
NEWBERG, OREGON

Designed by	URL	Date	11/2022
Drawn by	URL	Date	11/2022
Reviewed by	MLS	Date	11/2022
Project No.	121-029	REF.	
Horiz. Scale:			
Vert. Scale:			

By	Revision	Date	No.

Project: NEWBERG APPARTMENTS
No.: 121-029
Type: PLANNING
Sheet: P5.0

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RUNOFF CURVE NUMBERS (TR55)

Table 2-2a: Runoff curve numbers for urban areas [1]

Cover description		CN for hydrologic soil group				
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D	
Fully developed urban areas (vegetation established)						
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:						
Poor condition (grass cover <50%)		68	79	86	89	
Fair condition (grass cover 50% to 75%)		49	69	79	84	*Dev*
Good condition (grass cover >75%)		39	61	74	80	*Pre*
Impervious areas:						
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98	
Streets and roads:						
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98	
Paved; open ditches (including right-of-way)		83	89	92	93	
Gravel (including right-of-way)		76	85	89	91	
Dirt (including right-of-way)		72	82	87	89	
Western desert urban areas:						
Natural desert landscaping (pervious areas only) [4]		63	77	85	88	
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96	
Urban districts:						
Commercial and business	85	89	92	94	95	
Industrial	72	81	88	91	93	
Residential districts by average lot size:						
1/8 acre or less (town houses)	65	77	85	90	92	
1/4 acre	38	61	75	83	87	
1/3 acre	30	57	72	81	86	
1/2 acre	25	54	70	80	85	
1 acre	20	51	68	79	84	
2 acres	12	46	65	77	82	
Developing urban areas						
Newly graded areas (pervious areas only, no vegetation) [5]	77	86	91	94		
Idle lands (CNs are determined using cover types similar to those in table 2-2c)						

1: Average runoff condition, and $I_a = 0.2S$.

2: The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas hava a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3: CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4: Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5: Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

MANNING'S "n" VALUES

SHEET FLOW EQUATION MANNING'S VALUES	n_s
Smooth Surfaces (concrete, asphault, gravel, or bare hand packed soil)	0.011
Fallow Fields or loose soil surface (no residue)	0.05
Cultivated soil with residue cover ($\leq$ 20%)	0.06
Cultivated soil with residue cover (> 20%)	0.17
Short prairie grass and lawns	0.15
Dense grasses	0.24
Bermuda grasses	0.41
Range (natural)	0.13
Woods or forrest with light underbrush	0.40
Woods or forrest with dense underbrush	0.80

SHALLOW CONCENTRATED FLOW (after initial 300 ft of sheet flow, R = 0.1)	k_s
Forrest with heavy ground litter and meadows (n = 0.010)	3
Brushy ground with some trees (n = 0.060)	5
Fallow or minimum tillage cultivation (n = 0.040)	8
High grass (n = 0.035)	9
Short grass, pasture and lawns (n = 0.030)	11
Nearly bare ground (n = 0.25)	13
Paved and gravel areas (n = 0.012)	27

CHANNEL FLOW (Intermittent) (At the beginning of all visible channels, R = 0.2)	k_c
Forested swale with heavy ground cover (n = 0.10)	5
Forested drainage course/ravine with defined channel bed (n = 0.050)	10
Rock-lined waterway (n = 0.035)	15
Grassed waterway (n = 0.030)	17
Earth-lined waterway (n = 0.025)	20
CMP pipe (n = 0.024)	21
Concrete pipe (n = 0.012)	42
Other waterways and pipe 0.508/n	

CHANNEL FLOW (continuous stream, R = 0.4)	k_c
Meandering stream (n = 0.040)	20
Rock-lined stream (n = 0.035)	23
Grass-lined stream (n = 0.030)	27
Other streams, man-made channels and pipe (n = 0.807/n)	

PIONEER DESIGN GROUP

IMPERVIOUS AREA CALCULATIONS

JOB NUMBER: 121-029
PROJECT: Newberg Apartments
FILE: 12129_hydro_planning

NEW IMPERVIOUS AREA

BUILDING	9,562.00 ft^2	
SIDEWALKS	3,314.00 ft^2	
STREET PAVEMENT	14,596.00 ft^2	
	27,472.00 ft^2	**0.63 ac**

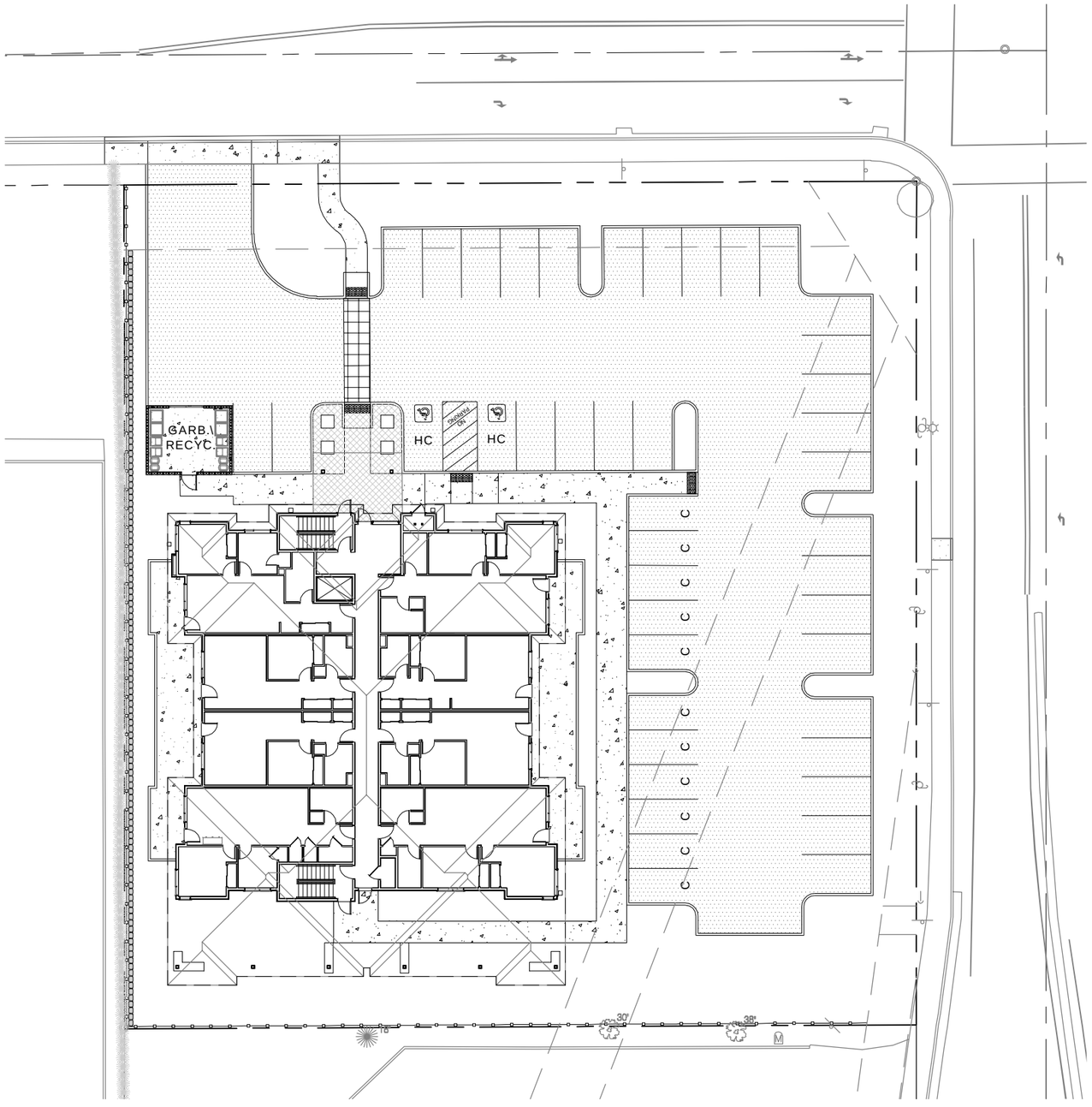
EXISTING IMPERVIOUS AREA

BUILDINGS	0.00 ft^2	
SIDEWALKS	0.00 ft^2	
GRAVEL AT 60% IMPERVIOUS	0.00 ft^2	
STREET PAVEMENT	0.00 ft^2	
	0.00 ft^2	**0.00 ac**

Total Shed Area	**35,725.00 ft^2**	**0.82 ac**
Existing Impervious Area	**0.00 ft^2**	**0.00 ac**
% Impervious		**0.0 %**
Proposed Impervious Area	**27,472.00 ft^2**	**0.63 ac**
% Impervious		**76.9 %**

Impervious Area Exhibit

THE HAWORTH APARTMENTS



DISTURBED AREA

ONSITE	=	35,725 SF (0.82 AC)
OFFSITE	=	521 SF (0.01 AC)
TOTAL DISTURBED AREA	=	36,246 SF (0.83 AC)

IMPERVIOUS AREA

BUILDING	=	0 SF
SIDEWALK	=	0 SF
PAVEMENT	=	0 SF
TOTAL EXISTING IMPERVIOUS	=	0 SF (0.00 AC)
BUILDING	=	9,562 SF
SIDEWALKS	=	3,314 SF
PAVEMENT	=	14,596 SF
TOTAL PROPOSED IMPERVIOUS	=	27,472 SF (0.63 AC)

SCALE
30 0 15 30
1 INCH = 30 FEET

PIONEER DESIGN GROUP
CIVIL ENGINEERING • LAND USE PLANNING • LAND SURVEYING • LANDSCAPE ARCHITECTURE
PORTLAND, OREGON | HONOLULU, HAWAII
PH: 503.643.8286 | PH: 808.753.2376
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Designed by	LRL	Date	11/2022
Drawn by	LRL	Date	11/2022
Reviewed by	BEF	Date	11/2022
Project No.	121-029	REF.	
Horiz. Scale:	1"=30'		
Vert. Scale:			

Impervious Area Exhibit.dwg

Project
THE HAWORTH

No.
121-029

Type
PLANNING

Sheet
1 of 1

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PIONEER DESIGN GROUP

PREDEVELOPED TIME OF CONCENTRATION

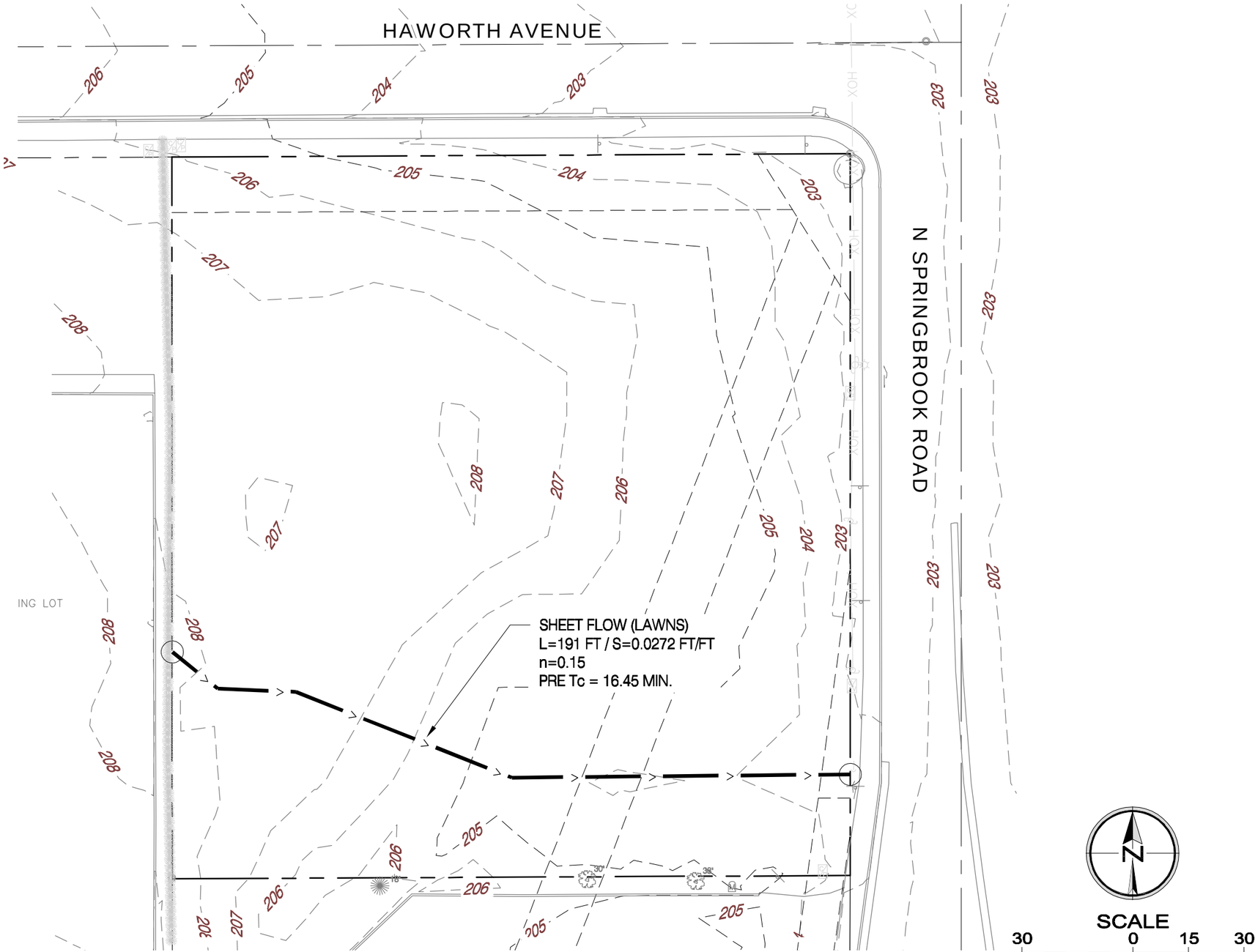
JOB NUMBER: 121-029
PROJECT: Newberg Apartments
FILE: 12129_hydro_planning

			Accum. Tc
LAG ONE: SHEET FLOW (FIRST 191 FEET)			
Tt = Travel time			
Manning's "n " =	0.15		
Flow Length, L =	191 ft	(300 ft. max.)	
P = 2-year, 24hr storm =	2.5 in		
Slope, S_0 =	0.027 ft/ft		
$T_T = \frac{(0.42)(n * L)^{0.8}}{(P)^{0.5}(S_0)^{0.4}}$	16.45 min.		16.45 min.

TOTAL PREDEVELOPED TIME OF CONCENTRATION (Tc) = 16.45 min.

Predeveloped Time of Concentration

THE HAWORTH



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Designed by	LRL	Date	11/2022		
Drawn by	LRL	Date	11/2022		
Reviewed by	BEF	Date	11/2022		
Project No.	121-029	REF.			
Horiz. Scale:	1"=30'				
Vert. Scale:	N/A				

12129_ PRE Tc.DWG

Project
HAWORTH APARTMENTS

No.
121-029

Type
PLANNING

Sheet
1 of 1

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PIONEER DESIGN GROUP

DEVELOPED TIME OF CONCENTRATION

JOB NUMBER: 121-029
PROJECT: Newberg Apartments
FILE: 12129_hydro_planning

Catchment Time	5 min.
Longest Run of Pipe	0 ft
Velocity of Flow	3 ft/s
Time in Pipe = (0 ft)/(3.00 ft/s) =	0 s
TOTAL DEVELOPED Tc =	**5 min.**

PIONEER DESIGN GROUP

EXISTING CONDITIONS - PERVIOUS COMPOSITE CURVE NUMBERS

JOB NUMBER: 121-029
PROJECT: Newberg Apartments
FILE: 12129_hydro_planning

TOTAL AREA= 35,725 SF

EXISTING CONDITIONS

COVER TYPE	SOIL TYPE	AREA (SF)	SOIL GRADE	CURVE NUMBER
OPEN SPACE "GOOD CONDITION"	2027A Verbort silty clay loam	23,817	D	80
OPEN SPACE "GOOD CONDITION"	2310A Cornelius silt loam	11,908	C	74

EXISTING COMPOSITE CN (PERVIOUS) = $\frac{(109{,}447 \times 71) + (130569 \times 84)}{35{,}725}$ = **78.0**

PIONEER DESIGN GROUP

DEVELOPED CONDITIONS - PERVIOUS COMPOSITE CURVE NUMBERS

JOB NUMBER: 121-029
PROJECT: Newberg Apartments
FILE: 12129_hydro_planning

TOTAL AREA= 35,725 SF

DEVELOPED CONDITIONS

COVER TYPE	SOIL TYPE	AREA (SF)	SOIL GRADE	CURVE NUMBER
OPEN SPACE "FAIR CONDITION"	2027A Verbort silty clay loam	23,817	D	84
OPEN SPACE "FAIR CONDITION"	2310A Woodburn silt loam	11,908	C	79

DEVELOPED COMPOSITE CN (PERVIOUS) = $\frac{(109{,}447 \times 71) + (130569 \times 84)}{35{,}725}$ = **82.3**

PIONEER DESIGN GROUP

STORMWATER CONVEYANCE CALCULATIONS

JOB NUMBER: 121-029
PROJECT: Newberg Apartments

FILE: 12129_hydro_planning
Design Storm: 25 YR
Storm Duration: 24 HRS
Precipitation: 4 IN
Manning's "n" 0.013

LINE	INC. AREA (AC)	AREA TOTAL (AC)	% IMP.	AREA PERV. (AC)	CN PER.	AREA IMP. (AC)	CN IMP.	TIME (MIN)	Q (CFS)	PIPE SIZE (IN)	SLOPE (FT/FT)	Qf (CFS)	Q/Qf (%)	Vf (FPS)	V/Vf (%)	ACTUAL V (FPS)
ENTIRE SHED	0.82	0.82	76.9	0.19	82.3	0.63	98	5.00	0.77	6	0.0100	0.56	1.37	2.87	1.14	3.26
ENTIRE SHED	0.82	0.82	76.9	0.19	82.3	0.63	98	5.00	0.77	8	0.0075	1.05	0.74	3.01	1.12	3.37
ENTIRE SHED	0.82	0.82	76.9	0.19	82.3	0.63	98	5.00	0.77	10	0.0060	1.70	0.45	3.12	0.97	3.04
ENTIRE SHED	0.82	0.82	76.9	0.19	82.3	0.63	98	5.00	0.77	12	0.0050	2.53	0.31	3.22	0.86	2.78

23,230 sq. ft. @ 1.3 in./hr/ (6" Pipe)

16,461 sq. ft. @ 1.3 in./hr/ (6" Pipe)

SITE AREA = 35,719 SF

35,384 sq. ft. @ 1.3 in./hr/ (8" Pipe)

TABLE 11-2
SIZING OF HORIZONTAL RAINWATER PIPING[1, 2]

SIZE OF PIPE	FLOW (⅛ inch per foot slope)	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)					
inches	gpm	1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)
3	34	3288	1644	1096	822	657	548
4	78	7520	3760	2506	1880	1504	1253
5	139	13 360	6680	4453	3340	2672	2227
6	222	21 400	10 700	7133	5350	4280	3566
8	478	46 000	23 000	15 330	11 500	9200	7670
10	860	82 800	41 400	27 600	20 700	16 580	13 800
12	1384	133 200	66 600	44 400	33 300	26 650	22 200
15	2473	238 000	119 000	79 333	59 500	47 600	39 650

SIZE OF PIPE	FLOW (¼ inch per foot slope)	MAXIMUM [illegible] TAL PROJECTED ROOF AREAS NFALL RATES feet)					
inches	gpm	1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)
3	48	4640	2320	1546	1160	928	773
4	110	10 600	5300	3533	2650	2120	1766
5	196	18 880	9440	6293	4720	3776	3146
6	314	30 200	15 100	10 066	7550	6040	5033
8	677	65 200	32 600	21 733	16 300	13 040	10 866
10	1214	116 800	58 400	38 950	29 200	23 350	19 450
12	1953	188 000	94 000	62 600	47 000	37 600	31 350
15	3491	336 000	168 000	112 000	84 000	67 250	56 000

SIZE OF PIPE	FLOW (½ inch per foot slope)	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)					
inches	gpm	1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)
3	68	6576	3288	2192	1644	1310	1096
4	156	15 040	7520	5010	3760	3010	2500
5	278	26 720	13 360	8900	6680	5320	4450
6	445	42 800	21 400	14 267	10 700	8580	7140
8	956	92 000	46 000	30 650	23 000	18 400	15 320
10	1721	165 600	82 800	55 200	41 400	33 150	27 600
12	2768	266 400	133 200	88 800	66 600	53 200	44 400
15	4946	476 000	238 000	158 700	119 000	95 200	79 300

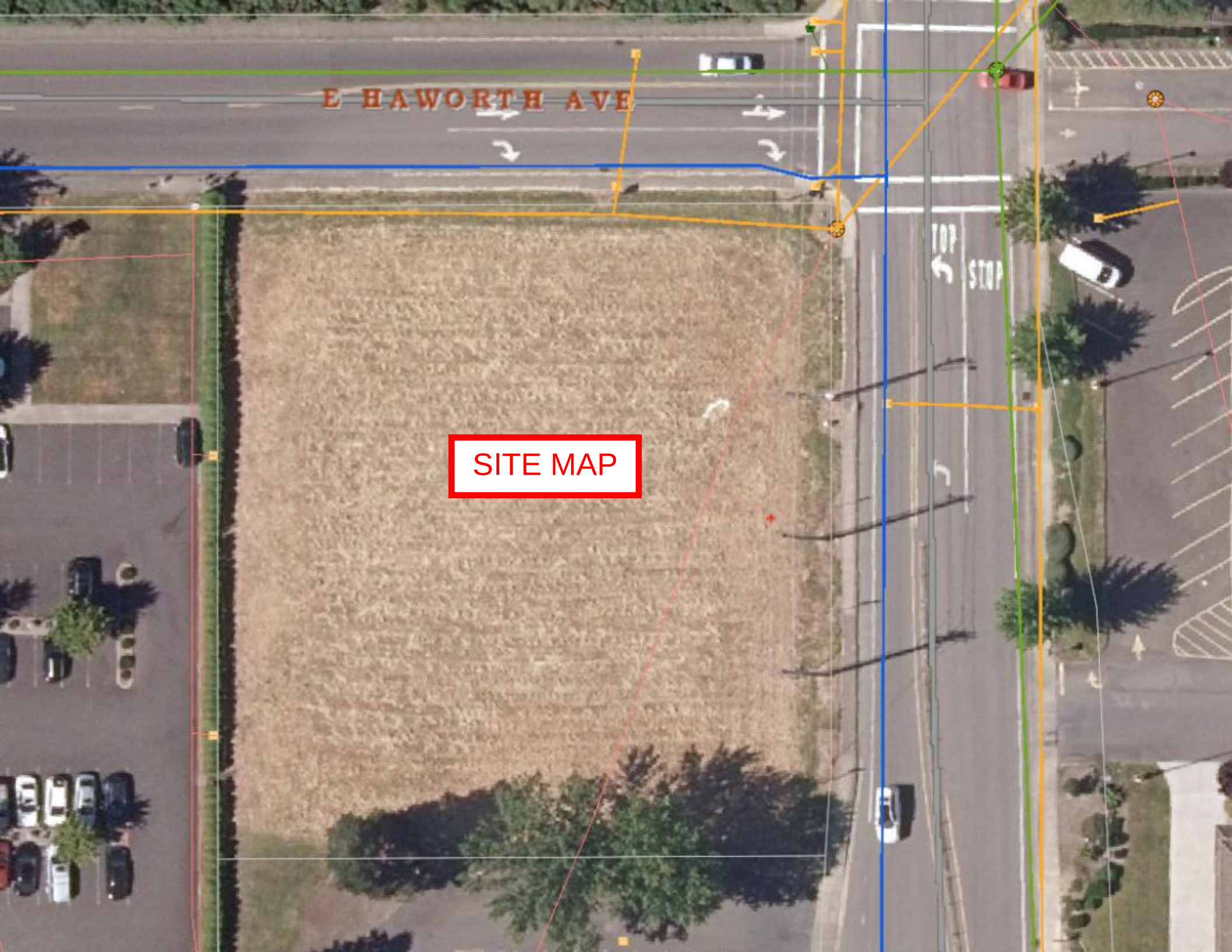
For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, ⅛ inch per foot = 10.4 mm/m, 1 inch per hour = 25.4 mm/h, 1 square foot = 0.0929 m^2

Notes:

[1] The sizing data for horizontal piping are based on the pipes flowing full.

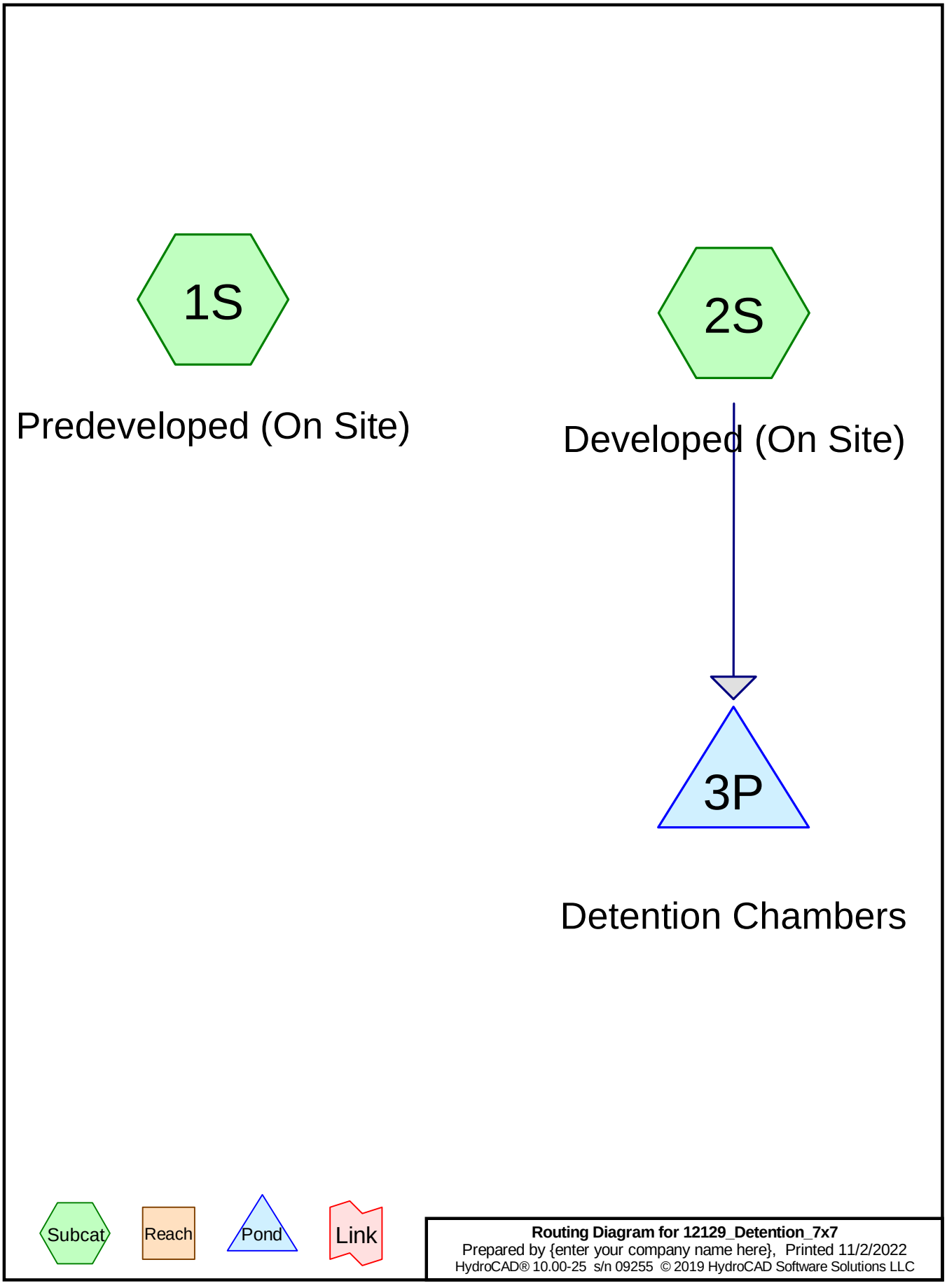
[2] For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch per hour (25.4 mm/h) column by the desired rainfall rate.

APPENDIX 'A' – CITY OF NEWBERG UTILITY MAPS


E HAWORTH AVE
SITE MAP


OVERALL
MAP

APPENDIX 'B' – DETENTION CHAMBER SIZING CALCULATIONS



Routing Diagram for 12129_Detention_7x7
Prepared by {enter your company name here}, Printed 11/2/2022

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.820	78	(1S)
0.190	82	(2S)
0.630	98	(2S)
1.640	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
1.640	Other	1S, 2S
1.640		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	1.640	1.640		1S, 2S
0.000	**0.000**	**0.000**	**0.000**	**1.640**	**1.640**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	3P	195.96	195.65	31.0	0.0100	0.013	12.0	0.0	0.0

Time span=0.00-50.00 hrs, dt=0.01 hrs, 5001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Predeveloped (On Site) Runoff Area=0.820 ac 0.00% Impervious Runoff Depth=0.13"
Tc=16.4 min CN=78/0 Runoff=0.01 cfs 0.009 af

Subcatchment 2S: Developed (On Site) Runoff Area=0.820 ac 76.83% Impervious Runoff Depth=0.85"
Tc=5.0 min CN=82/98 Runoff=0.17 cfs 0.058 af

Pond 3P: Detention Chambers Peak Elev=197.21' Storage=441 cf Inflow=0.17 cfs 0.058 af
Outflow=0.04 cfs 0.058 af

Total Runoff Area = 1.640 ac Runoff Volume = 0.067 af Average Runoff Depth = 0.49"
61.59% Pervious = 1.010 ac 38.41% Impervious = 0.630 ac

Summary for Subcatchment 1S: Predeveloped (On Site)

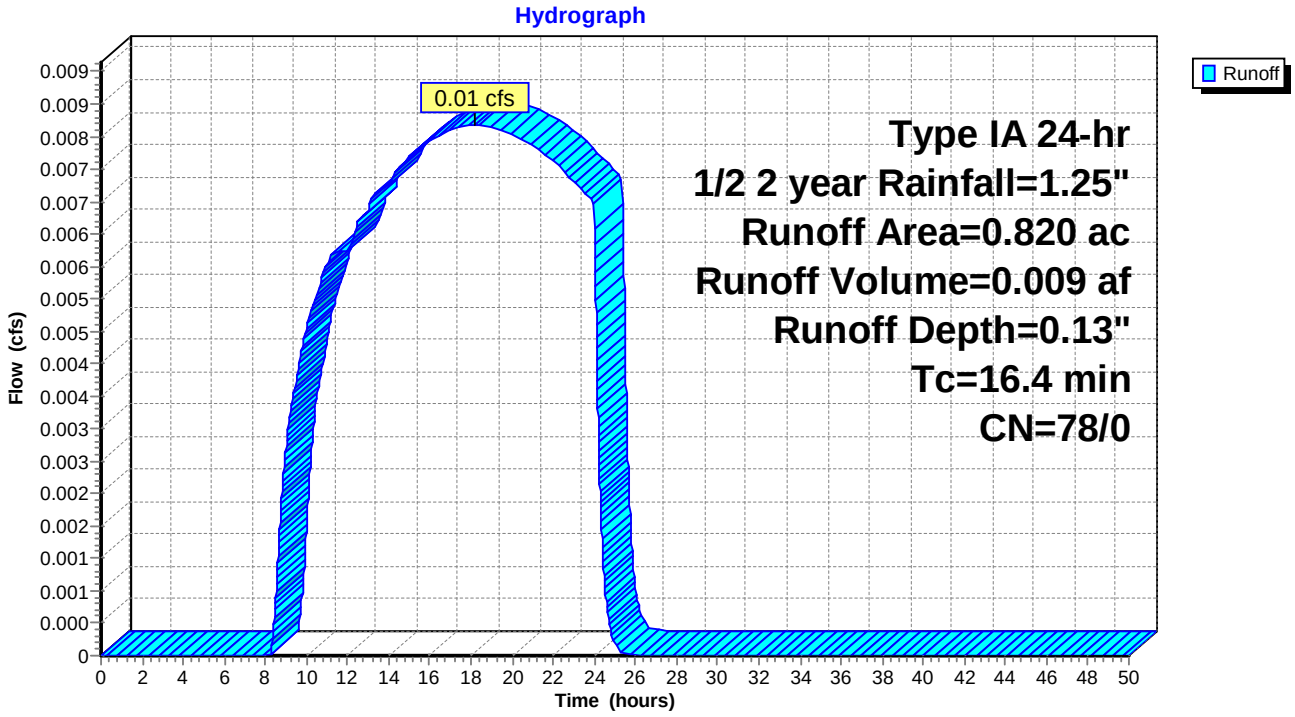
Runoff = 0.01 cfs @ 18.15 hrs, Volume= 0.009 af, Depth= 0.13"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.25"

	Area (ac)	CN	Description
*	0.820	78	
	0.820	78	100.00% Pervious Area

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

Subcatchment 1S: Predeveloped (On Site)



Hydrograph for Subcatchment 1S: Predeveloped (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
0.50	0.01	0.00	0.00	0.00
1.00	0.02	0.00	0.00	0.00
1.50	0.04	0.00	0.00	0.00
2.00	0.06	0.00	0.00	0.00
2.50	0.08	0.00	0.00	0.00
3.00	0.10	0.00	0.00	0.00
3.50	0.12	0.00	0.00	0.00
4.00	0.15	0.00	0.00	0.00
4.50	0.17	0.00	0.00	0.00
5.00	0.19	0.00	0.00	0.00
5.50	0.23	0.00	0.00	0.00
6.00	0.26	0.00	0.00	0.00
6.50	0.30	0.00	0.00	0.00
7.00	0.34	0.00	0.00	0.00
7.50	0.39	0.00	0.00	0.00
8.00	0.53	0.00	0.00	0.00
8.50	0.60	0.00	0.00	0.00
9.00	0.65	0.00	0.00	0.00
9.50	0.69	0.01	0.00	0.00
10.00	0.72	0.01	0.00	0.01
10.50	0.75	0.01	0.00	0.01
11.00	0.78	0.02	0.00	0.01
11.50	0.81	0.02	0.00	0.01
12.00	0.83	0.02	0.00	0.01
12.50	0.85	0.03	0.00	0.01
13.00	0.88	0.03	0.00	0.01
13.50	0.90	0.04	0.00	0.01
14.00	0.92	0.04	0.00	0.01
14.50	0.94	0.04	0.00	0.01
15.00	0.96	0.05	0.00	0.01
15.50	0.98	0.05	0.00	0.01
16.00	1.00	0.06	0.00	0.01
16.50	1.02	0.06	0.00	0.01
17.00	1.04	0.07	0.00	0.01
17.50	1.06	0.07	0.00	0.01
18.00	1.07	0.08	0.00	**0.01**
18.50	1.09	0.08	0.00	**0.01**
19.00	1.11	0.09	0.00	0.01
19.50	1.13	0.09	0.00	0.01
20.00	1.14	0.10	0.00	0.01
20.50	1.16	0.10	0.00	0.01
21.00	1.17	0.11	0.00	0.01
21.50	1.19	0.11	0.00	0.01
22.00	1.20	0.12	0.00	0.01
22.50	1.21	0.12	0.00	0.01
23.00	1.23	0.13	0.00	0.01
23.50	1.24	0.13	0.00	0.01
24.00	**1.25**	**0.13**	0.00	0.01
24.50	1.25	0.13	0.00	0.00
25.00	1.25	0.13	0.00	0.00
25.50	1.25	0.13	0.00	0.00
26.00	1.25	0.13	0.00	0.00
26.50	1.25	0.13	0.00	0.00
27.00	1.25	0.13	0.00	0.00
27.50	1.25	0.13	0.00	0.00
28.00	1.25	0.13	0.00	0.00
28.50	1.25	0.13	0.00	0.00
29.00	1.25	0.13	0.00	0.00
29.50	1.25	0.13	0.00	0.00
30.00	1.25	0.13	0.00	0.00
30.50	1.25	0.13	0.00	0.00
31.00	1.25	0.13	0.00	0.00
31.50	1.25	0.13	0.00	0.00
32.00	1.25	0.13	0.00	0.00
32.50	1.25	0.13	0.00	0.00
33.00	1.25	0.13	0.00	0.00
33.50	1.25	0.13	0.00	0.00
34.00	1.25	0.13	0.00	0.00
34.50	1.25	0.13	0.00	0.00
35.00	1.25	0.13	0.00	0.00
35.50	1.25	0.13	0.00	0.00
36.00	1.25	0.13	0.00	0.00
36.50	1.25	0.13	0.00	0.00
37.00	1.25	0.13	0.00	0.00
37.50	1.25	0.13	0.00	0.00
38.00	1.25	0.13	0.00	0.00
38.50	1.25	0.13	0.00	0.00
39.00	1.25	0.13	0.00	0.00
39.50	1.25	0.13	0.00	0.00
40.00	1.25	0.13	0.00	0.00
40.50	1.25	0.13	0.00	0.00
41.00	1.25	0.13	0.00	0.00
41.50	1.25	0.13	0.00	0.00
42.00	1.25	0.13	0.00	0.00
42.50	1.25	0.13	0.00	0.00
43.00	1.25	0.13	0.00	0.00
43.50	1.25	0.13	0.00	0.00
44.00	1.25	0.13	0.00	0.00
44.50	1.25	0.13	0.00	0.00
45.00	1.25	0.13	0.00	0.00
45.50	1.25	0.13	0.00	0.00
46.00	1.25	0.13	0.00	0.00
46.50	1.25	0.13	0.00	0.00
47.00	1.25	0.13	0.00	0.00
47.50	1.25	0.13	0.00	0.00
48.00	1.25	0.13	0.00	0.00
48.50	1.25	0.13	0.00	0.00
49.00	1.25	0.13	0.00	0.00
49.50	1.25	0.13	0.00	0.00
50.00	1.25	0.13	0.00	0.00

Summary for Subcatchment 2S: Developed (On Site)

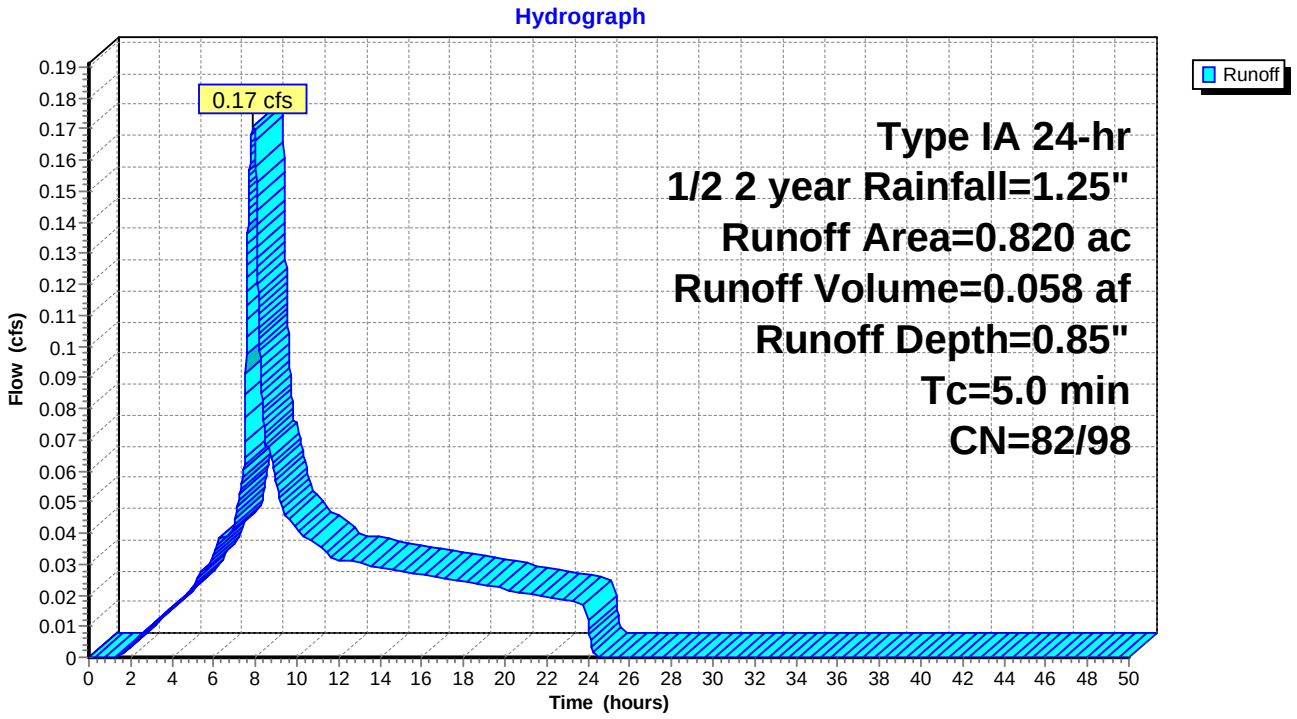
Runoff = 0.17 cfs @ 7.91 hrs, Volume= 0.058 af, Depth= 0.85"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 2 year Rainfall=1.25"

	Area (ac)	CN	Description
*	0.190	82	
*	0.630	98	
	0.820	94	Weighted Average
	0.190	82	23.17% Pervious Area
	0.630	98	76.83% Impervious Area

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

Subcatchment 2S: Developed (On Site)



Hydrograph for Subcatchment 2S: Developed (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
0.50	0.01	0.00	0.00	0.00
1.00	0.02	0.00	0.00	0.00
1.50	0.04	0.00	0.00	0.00
2.00	0.06	0.00	0.00	0.00
2.50	0.08	0.00	0.01	0.01
3.00	0.10	0.00	0.01	0.01
3.50	0.12	0.00	0.02	0.01
4.00	0.15	0.00	0.04	0.02
4.50	0.17	0.00	0.05	0.02
5.00	0.19	0.00	0.07	0.02
5.50	0.23	0.00	0.09	0.03
6.00	0.26	0.00	0.11	0.03
6.50	0.30	0.00	0.14	0.04
7.00	0.34	0.00	0.17	0.04
7.50	0.39	0.00	0.22	**0.06**
8.00	0.53	0.00	0.35	**0.17**
8.50	0.60	0.01	0.41	0.07
9.00	0.65	0.02	0.46	0.06
9.50	0.69	0.03	0.49	0.04
10.00	0.72	0.03	0.52	0.04
10.50	0.75	0.04	0.55	0.04
11.00	0.78	0.05	0.58	0.04
11.50	0.81	0.05	0.60	0.03
12.00	0.83	0.06	0.63	0.03
12.50	0.85	0.07	0.65	0.03
13.00	0.88	0.07	0.67	0.03
13.50	0.90	0.08	0.69	0.03
14.00	0.92	0.09	0.71	0.03
14.50	0.94	0.09	0.73	0.03
15.00	0.96	0.10	0.75	0.03
15.50	0.98	0.11	0.77	0.03
16.00	1.00	0.11	0.79	0.03
16.50	1.02	0.12	0.81	0.03
17.00	1.04	0.13	0.83	0.03
17.50	1.06	0.14	0.85	0.02
18.00	1.07	0.14	0.86	0.02
18.50	1.09	0.15	0.88	0.02
19.00	1.11	0.16	0.90	0.02
19.50	1.13	0.16	0.91	0.02
20.00	1.14	0.17	0.93	0.02
20.50	1.16	0.18	0.94	0.02
21.00	1.17	0.18	0.96	0.02
21.50	1.19	0.19	0.97	0.02
22.00	1.20	0.20	0.98	0.02
22.50	1.21	0.20	1.00	0.02
23.00	1.23	0.21	1.01	0.02
23.50	1.24	0.21	1.02	0.02
24.00	**1.25**	**0.22**	**1.03**	0.02
24.50	1.25	0.22	1.03	0.00
25.00	1.25	0.22	1.03	0.00
25.50	1.25	0.22	1.03	0.00
26.00	1.25	0.22	1.03	0.00
26.50	1.25	0.22	1.03	0.00
27.00	1.25	0.22	1.03	0.00
27.50	1.25	0.22	1.03	0.00
28.00	1.25	0.22	1.03	0.00
28.50	1.25	0.22	1.03	0.00
29.00	1.25	0.22	1.03	0.00
29.50	1.25	0.22	1.03	0.00
30.00	1.25	0.22	1.03	0.00
30.50	1.25	0.22	1.03	0.00
31.00	1.25	0.22	1.03	0.00
31.50	1.25	0.22	1.03	0.00
32.00	1.25	0.22	1.03	0.00
32.50	1.25	0.22	1.03	0.00
33.00	1.25	0.22	1.03	0.00
33.50	1.25	0.22	1.03	0.00
34.00	1.25	0.22	1.03	0.00
34.50	1.25	0.22	1.03	0.00
35.00	1.25	0.22	1.03	0.00
35.50	1.25	0.22	1.03	0.00
36.00	1.25	0.22	1.03	0.00
36.50	1.25	0.22	1.03	0.00
37.00	1.25	0.22	1.03	0.00
37.50	1.25	0.22	1.03	0.00
38.00	1.25	0.22	1.03	0.00
38.50	1.25	0.22	1.03	0.00
39.00	1.25	0.22	1.03	0.00
39.50	1.25	0.22	1.03	0.00
40.00	1.25	0.22	1.03	0.00
40.50	1.25	0.22	1.03	0.00
41.00	1.25	0.22	1.03	0.00
41.50	1.25	0.22	1.03	0.00
42.00	1.25	0.22	1.03	0.00
42.50	1.25	0.22	1.03	0.00
43.00	1.25	0.22	1.03	0.00
43.50	1.25	0.22	1.03	0.00
44.00	1.25	0.22	1.03	0.00
44.50	1.25	0.22	1.03	0.00
45.00	1.25	0.22	1.03	0.00
45.50	1.25	0.22	1.03	0.00
46.00	1.25	0.22	1.03	0.00
46.50	1.25	0.22	1.03	0.00
47.00	1.25	0.22	1.03	0.00
47.50	1.25	0.22	1.03	0.00
48.00	1.25	0.22	1.03	0.00
48.50	1.25	0.22	1.03	0.00
49.00	1.25	0.22	1.03	0.00
49.50	1.25	0.22	1.03	0.00
50.00	1.25	0.22	1.03	0.00

Summary for Pond 3P: Detention Chambers

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.820 ac, 76.83% Impervious, Inflow Depth = 0.85" for 1/2 2 year event
Inflow = 0.17 cfs @ 7.91 hrs, Volume= 0.058 af
Outflow = 0.04 cfs @ 9.93 hrs, Volume= 0.058 af, Atten= 75%, Lag= 121.4 min
Primary = 0.04 cfs @ 9.93 hrs, Volume= 0.058 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 197.21' @ 9.93 hrs Surf.Area= 1,685 sf Storage= 441 cf

Plug-Flow detention time= 89.3 min calculated for 0.058 af (100% of inflow)
Center-of-Mass det. time= 89.2 min (804.7 - 715.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.58'	1,094 cf	**32.75'W x 51.46'L x 3.50'H Field A** 5,898 cf Overall - 2,251 cf Embedded = 3,647 cf x 30.0% Voids
#2A	197.08'	2,251 cf	**ADS_StormTech SC-740 +Cap** x 49 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 49 Chambers in 7 Rows
		3,345 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	195.96'	**12.0" Round Culvert** L= 31.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 195.96' / 195.65' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	193.96'	**1.2" Vert. Orifice/Grate** C= 0.600
#3	Device 1	198.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	198.86'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.04 cfs @ 9.93 hrs HW=197.21' (Free Discharge)
└**1=Culvert** (Passes 0.04 cfs of 3.52 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.04 cfs @ 5.39 fps)
  ├**3=Orifice/Grate** (Controls 0.00 cfs)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Detention Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

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

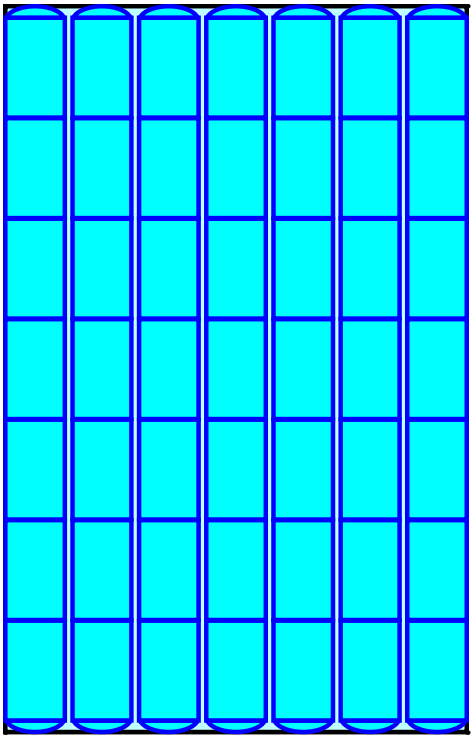
7 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 51.46' Row Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 = 32.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

49 Chambers x 45.9 cf = 2,251.1 cf Chamber Storage

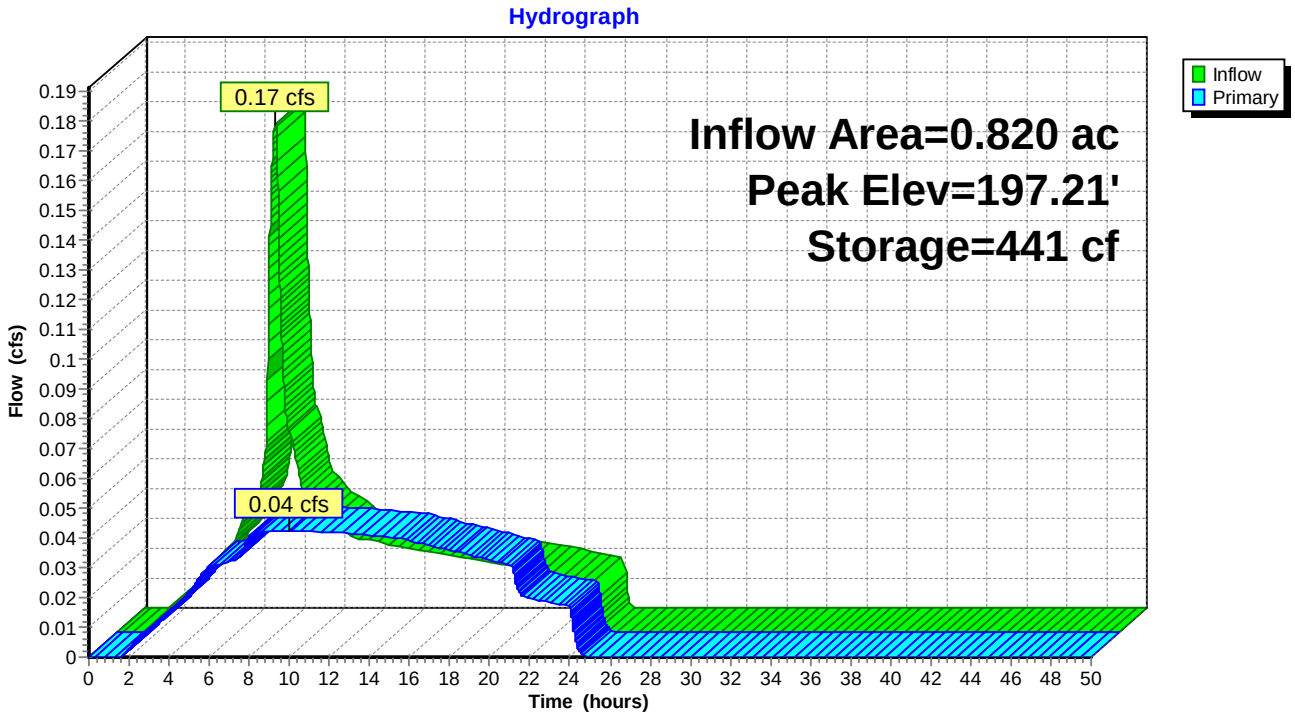
5,898.2 cf Field - 2,251.1 cf Chambers = 3,647.2 cf Stone x 30.0% Voids = 1,094.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,345.2 cf = 0.077 af
Overall Storage Efficiency = 56.7%
Overall System Size = 51.46' x 32.75' x 3.50'

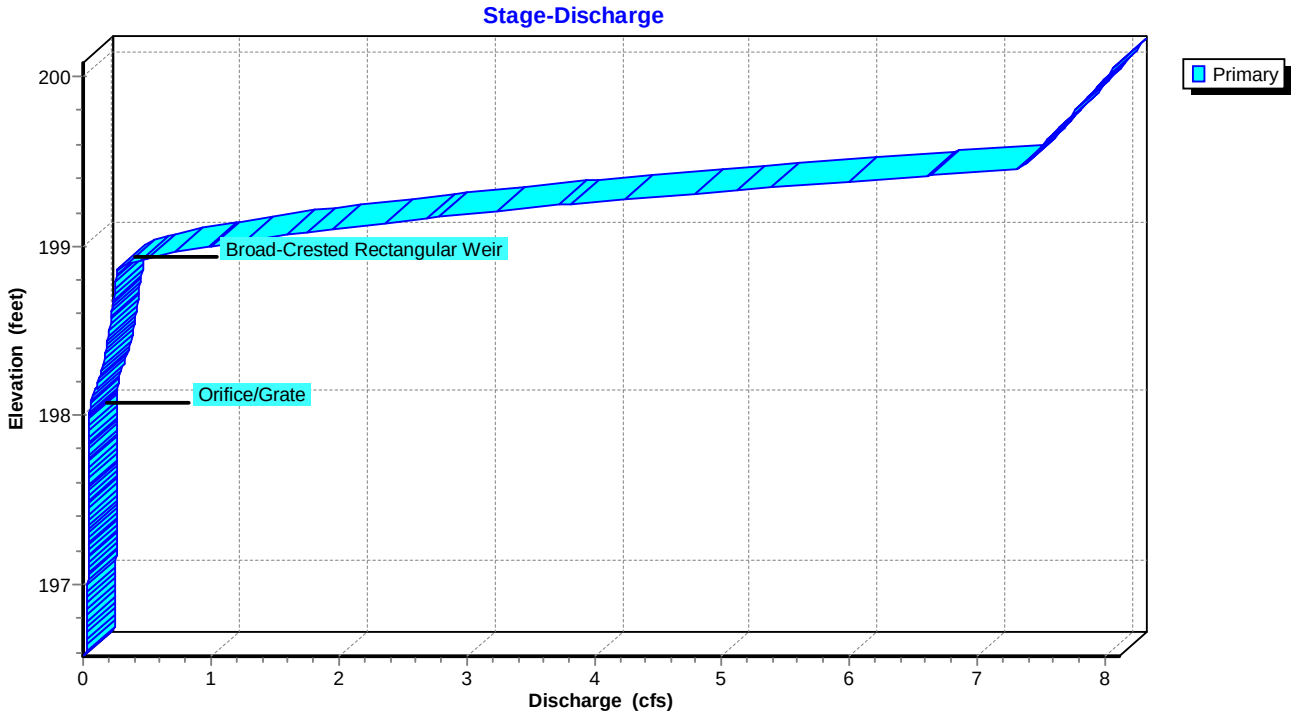
49 Chambers
218.5 cy Field
135.1 cy Stone



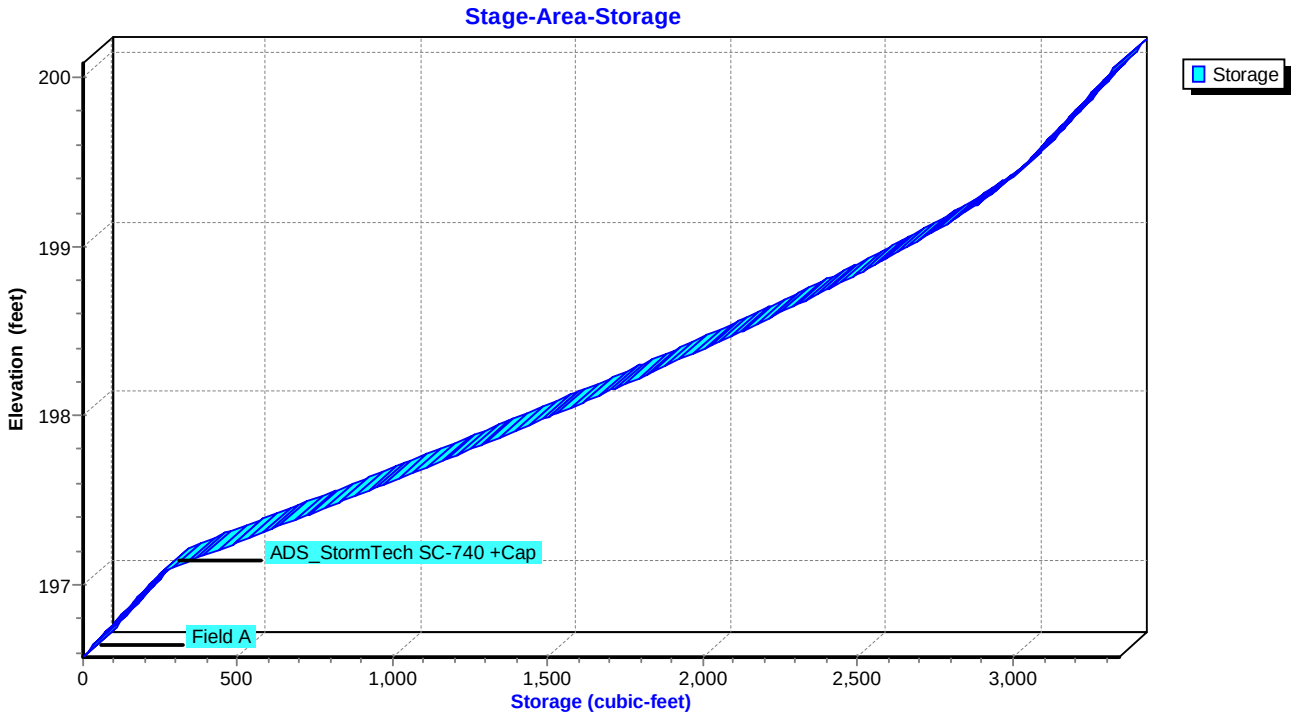
Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Hydrograph for Pond 3P: Detention Chambers

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	196.58	0.00
1.00	0.00	0	196.58	0.00
2.00	0.00	2	196.58	0.00
3.00	0.01	5	196.59	0.01
4.00	0.02	9	196.60	0.02
5.00	0.02	13	196.60	0.02
6.00	0.03	18	196.62	0.03
7.00	**0.04**	44	196.67	0.03
8.00	**0.17**	278	197.10	0.04
9.00	0.06	**425**	**197.20**	**0.04**
10.00	0.04	**441**	**197.21**	**0.04**
11.00	0.04	427	197.20	0.04
12.00	0.03	396	197.18	0.04
13.00	0.03	358	197.15	0.04
14.00	0.03	316	197.12	0.04
15.00	0.03	272	197.09	0.04
16.00	0.03	226	197.03	0.04
17.00	0.03	183	196.94	0.04
18.00	0.02	140	196.86	0.04
19.00	0.02	100	196.78	0.03
20.00	0.02	61	196.70	0.03
21.00	0.02	23	196.63	0.03
22.00	0.02	11	196.60	0.02
23.00	0.02	11	196.60	0.02
24.00	0.02	10	196.60	0.02
25.00	0.00	0	196.58	0.00
26.00	0.00	0	196.58	0.00
27.00	0.00	0	196.58	0.00
28.00	0.00	0	196.58	0.00
29.00	0.00	0	196.58	0.00
30.00	0.00	0	196.58	0.00
31.00	0.00	0	196.58	0.00
32.00	0.00	0	196.58	0.00
33.00	0.00	0	196.58	0.00
34.00	0.00	0	196.58	0.00
35.00	0.00	0	196.58	0.00
36.00	0.00	0	196.58	0.00
37.00	0.00	0	196.58	0.00
38.00	0.00	0	196.58	0.00
39.00	0.00	0	196.58	0.00
40.00	0.00	0	196.58	0.00
41.00	0.00	0	196.58	0.00
42.00	0.00	0	196.58	0.00
43.00	0.00	0	196.58	0.00
44.00	0.00	0	196.58	0.00
45.00	0.00	0	196.58	0.00
46.00	0.00	0	196.58	0.00
47.00	0.00	0	196.58	0.00
48.00	0.00	0	196.58	0.00
49.00	0.00	0	196.58	0.00
50.00	0.00	0	196.58	0.00

Stage-Discharge for Pond 3P: Detention Chambers

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
196.58	0.00	197.66	0.05	198.74	0.25	199.82	7.79
196.60	0.03	197.68	0.05	198.76	0.25	199.84	7.82
196.62	0.03	197.70	0.05	198.78	0.25	199.86	7.84
196.64	0.03	197.72	0.05	198.80	0.26	199.88	7.87
196.66	0.03	197.74	0.05	198.82	0.26	199.90	7.89
196.68	0.03	197.76	0.05	198.84	0.26	199.92	7.92
196.70	0.03	197.78	0.05	198.86	0.27	199.94	7.94
196.72	0.03	197.80	0.05	198.88	0.31	199.96	7.96
196.74	0.03	197.82	0.05	198.90	0.38	199.98	7.99
196.76	0.03	197.84	0.05	198.92	0.48	200.00	8.01
196.78	0.03	197.86	0.05	198.94	0.60	200.02	8.04
196.80	0.03	197.88	0.05	198.96	0.72	200.04	8.06
196.82	0.04	197.90	0.05	198.98	0.87	200.06	8.08
196.84	0.04	197.92	0.05	199.00	1.02	200.08	**8.11**
196.86	0.04	197.94	0.05	199.02	1.19		
196.88	0.04	197.96	0.05	199.04	1.36		
196.90	0.04	197.98	0.05	199.06	1.55		
196.92	0.04	198.00	0.05	199.08	1.75		
196.94	0.04	198.02	0.06	199.10	1.96		
196.96	0.04	198.04	0.06	199.12	2.18		
196.98	0.04	198.06	0.06	199.14	2.42		
197.00	0.04	198.08	0.07	199.16	2.66		
197.02	0.04	198.10	0.08	199.18	2.91		
197.04	0.04	198.12	0.08	199.20	3.17		
197.06	0.04	198.14	0.09	199.22	3.44		
197.08	0.04	198.16	0.10	199.24	3.72		
197.10	0.04	198.18	0.11	199.26	4.01		
197.12	0.04	198.20	0.12	199.28	4.32		
197.14	0.04	198.22	0.13	199.30	4.63		
197.16	0.04	198.24	0.14	199.32	4.96		
197.18	0.04	198.26	0.14	199.34	5.29		
197.20	0.04	198.28	0.15	199.36	5.64		
197.22	0.04	198.30	0.16	199.38	5.99		
197.24	0.04	198.32	0.16	199.40	6.35		
197.26	0.04	198.34	0.17	199.42	6.73		
197.28	0.04	198.36	0.17	199.44	7.11		
197.30	0.04	198.38	0.18	199.46	7.34		
197.32	0.04	198.40	0.18	199.48	7.36		
197.34	0.04	198.42	0.19	199.50	7.39		
197.36	0.04	198.44	0.19	199.52	7.42		
197.38	0.05	198.46	0.20	199.54	7.44		
197.40	0.05	198.48	0.20	199.56	7.47		
197.42	0.05	198.50	0.21	199.58	7.49		
197.44	0.05	198.52	0.21	199.60	7.52		
197.46	0.05	198.54	0.21	199.62	7.54		
197.48	0.05	198.56	0.22	199.64	7.57		
197.50	0.05	198.58	0.22	199.66	7.59		
197.52	0.05	198.60	0.22	199.68	7.62		
197.54	0.05	198.62	0.23	199.70	7.64		
197.56	0.05	198.64	0.23	199.72	7.67		
197.58	0.05	198.66	0.24	199.74	7.69		
197.60	0.05	198.68	0.24	199.76	7.72		
197.62	0.05	198.70	0.24	199.78	7.74		
197.64	0.05	198.72	0.25	199.80	7.77		

Stage-Area-Storage for Pond 3P: Detention Chambers

Elevation (feet)	Storage (cubic-feet)
196.58	0
196.63	25
196.68	51
196.73	76
196.78	101
196.83	126
196.88	152
196.93	177
196.98	202
197.03	228
197.08	253
197.13	323
197.18	394
197.23	465
197.28	535
197.33	605
197.38	675
197.43	744
197.48	813
197.53	882
197.58	950
197.63	1,019
197.68	1,086
197.73	1,154
197.78	1,220
197.83	1,287
197.88	1,353
197.93	1,418
197.98	1,484
198.03	1,548
198.08	1,612
198.13	1,676
198.18	1,739
198.23	1,801
198.28	1,863
198.33	1,924
198.38	1,985
198.43	2,044
198.48	2,104
198.53	2,162
198.58	2,220
198.63	2,276
198.68	2,332
198.73	2,387
198.78	2,441
198.83	2,494
198.88	2,546
198.93	2,596
198.98	2,646
199.03	2,694
199.08	2,741
199.13	2,786
199.18	2,830
199.23	2,872
199.28	2,911
199.33	2,947
199.38	2,980
199.43	3,010
199.48	3,039
199.53	3,066
199.58	3,092
199.63	3,118
199.68	3,143
199.73	3,168
199.78	3,194
199.83	3,219
199.88	3,244
199.93	3,269
199.98	3,295
200.03	3,320
200.08	**3,345**

Time span=0.00-50.00 hrs, dt=0.01 hrs, 5001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Predeveloped (On Site) Runoff Area=0.820 ac 0.00% Impervious Runoff Depth=0.79"
Tc=16.4 min CN=78/0 Runoff=0.09 cfs 0.054 af

Subcatchment 2S: Developed (On Site) Runoff Area=0.820 ac 76.83% Impervious Runoff Depth=1.98"
Tc=5.0 min CN=82/98 Runoff=0.40 cfs 0.135 af

Pond 3P: Detention Chambers Peak Elev=198.14' Storage=1,686 cf Inflow=0.40 cfs 0.135 af
Outflow=0.09 cfs 0.135 af

Total Runoff Area = 1.640 ac Runoff Volume = 0.189 af Average Runoff Depth = 1.38"
61.59% Pervious = 1.010 ac 38.41% Impervious = 0.630 ac

Summary for Subcatchment 1S: Predeveloped (On Site)

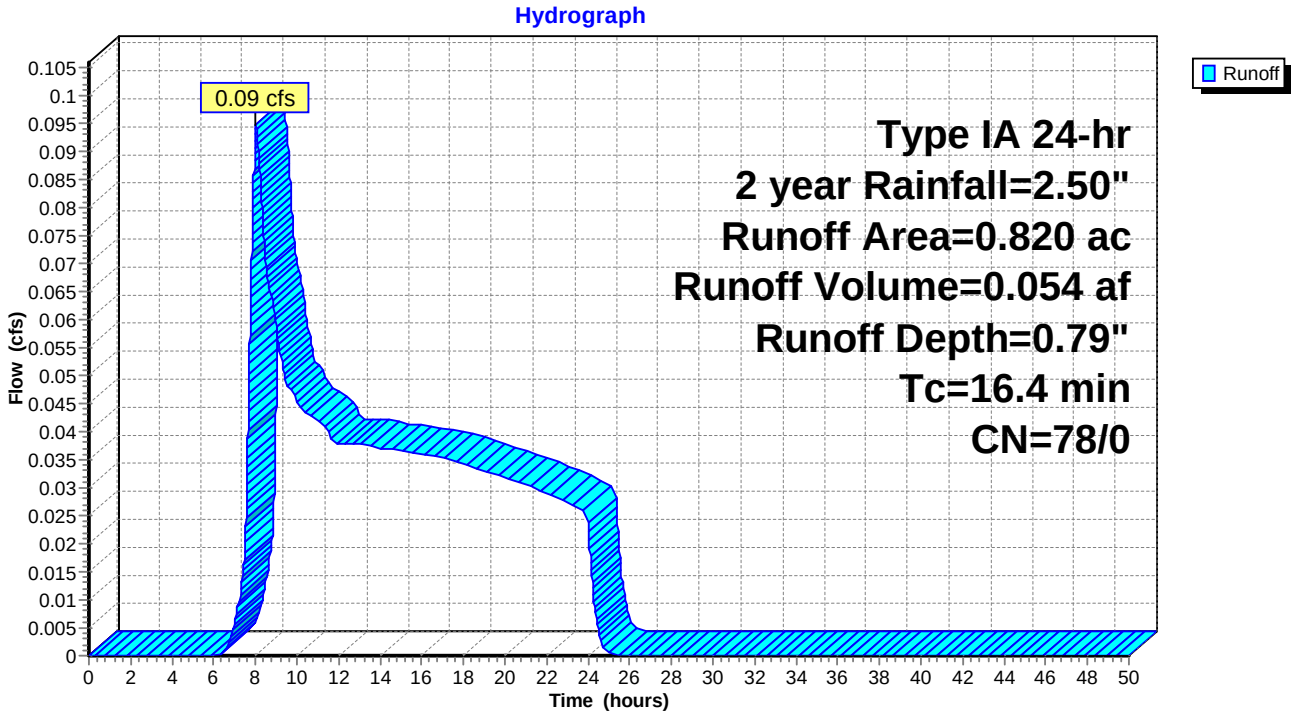
Runoff = 0.09 cfs @ 8.01 hrs, Volume= 0.054 af, Depth= 0.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 year Rainfall=2.50"

	Area (ac)	CN	Description
*	0.820	78	
	0.820	78	100.00% Pervious Area

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

Subcatchment 1S: Predeveloped (On Site)



Hydrograph for Subcatchment 1S: Predeveloped (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
0.50	0.02	0.00	0.00	0.00
1.00	0.05	0.00	0.00	0.00
1.50	0.09	0.00	0.00	0.00
2.00	0.13	0.00	0.00	0.00
2.50	0.16	0.00	0.00	0.00
3.00	0.20	0.00	0.00	0.00
3.50	0.25	0.00	0.00	0.00
4.00	0.29	0.00	0.00	0.00
4.50	0.34	0.00	0.00	0.00
5.00	0.39	0.00	0.00	0.00
5.50	0.45	0.00	0.00	0.00
6.00	0.51	0.00	0.00	0.00
6.50	0.59	0.00	0.00	0.00
7.00	0.67	0.00	0.00	0.01
7.50	0.78	0.01	0.00	0.02
8.00	1.06	0.07	0.00	**0.09**
8.50	1.20	0.12	0.00	**0.07**
9.00	1.30	0.15	0.00	0.06
9.50	1.37	0.18	0.00	0.05
10.00	1.44	0.21	0.00	0.05
10.50	1.50	0.23	0.00	0.04
11.00	1.56	0.26	0.00	0.04
11.50	1.61	0.28	0.00	0.04
12.00	1.66	0.31	0.00	0.04
12.50	1.71	0.33	0.00	0.04
13.00	1.75	0.35	0.00	0.04
13.50	1.80	0.38	0.00	0.04
14.00	1.84	0.40	0.00	0.04
14.50	1.88	0.42	0.00	0.04
15.00	1.92	0.44	0.00	0.04
15.50	1.96	0.46	0.00	0.04
16.00	2.00	0.49	0.00	0.04
16.50	2.04	0.51	0.00	0.04
17.00	2.08	0.53	0.00	0.04
17.50	2.11	0.55	0.00	0.03
18.00	2.15	0.57	0.00	0.03
18.50	2.18	0.59	0.00	0.03
19.00	2.22	0.61	0.00	0.03
19.50	2.25	0.63	0.00	0.03
20.00	2.28	0.65	0.00	0.03
20.50	2.31	0.67	0.00	0.03
21.00	2.34	0.69	0.00	0.03
21.50	2.37	0.71	0.00	0.03
22.00	2.40	0.72	0.00	0.03
22.50	2.43	0.74	0.00	0.03
23.00	2.45	0.76	0.00	0.03
23.50	2.48	0.77	0.00	0.03
24.00	**2.50**	**0.79**	0.00	0.03
24.50	2.50	0.79	0.00	0.00
25.00	2.50	0.79	0.00	0.00
25.50	2.50	0.79	0.00	0.00
26.00	2.50	0.79	0.00	0.00
26.50	2.50	0.79	0.00	0.00
27.00	2.50	0.79	0.00	0.00
27.50	2.50	0.79	0.00	0.00
28.00	2.50	0.79	0.00	0.00
28.50	2.50	0.79	0.00	0.00
29.00	2.50	0.79	0.00	0.00
29.50	2.50	0.79	0.00	0.00
30.00	2.50	0.79	0.00	0.00
30.50	2.50	0.79	0.00	0.00
31.00	2.50	0.79	0.00	0.00
31.50	2.50	0.79	0.00	0.00
32.00	2.50	0.79	0.00	0.00
32.50	2.50	0.79	0.00	0.00
33.00	2.50	0.79	0.00	0.00
33.50	2.50	0.79	0.00	0.00
34.00	2.50	0.79	0.00	0.00
34.50	2.50	0.79	0.00	0.00
35.00	2.50	0.79	0.00	0.00
35.50	2.50	0.79	0.00	0.00
36.00	2.50	0.79	0.00	0.00
36.50	2.50	0.79	0.00	0.00
37.00	2.50	0.79	0.00	0.00
37.50	2.50	0.79	0.00	0.00
38.00	2.50	0.79	0.00	0.00
38.50	2.50	0.79	0.00	0.00
39.00	2.50	0.79	0.00	0.00
39.50	2.50	0.79	0.00	0.00
40.00	2.50	0.79	0.00	0.00
40.50	2.50	0.79	0.00	0.00
41.00	2.50	0.79	0.00	0.00
41.50	2.50	0.79	0.00	0.00
42.00	2.50	0.79	0.00	0.00
42.50	2.50	0.79	0.00	0.00
43.00	2.50	0.79	0.00	0.00
43.50	2.50	0.79	0.00	0.00
44.00	2.50	0.79	0.00	0.00
44.50	2.50	0.79	0.00	0.00
45.00	2.50	0.79	0.00	0.00
45.50	2.50	0.79	0.00	0.00
46.00	2.50	0.79	0.00	0.00
46.50	2.50	0.79	0.00	0.00
47.00	2.50	0.79	0.00	0.00
47.50	2.50	0.79	0.00	0.00
48.00	2.50	0.79	0.00	0.00
48.50	2.50	0.79	0.00	0.00
49.00	2.50	0.79	0.00	0.00
49.50	2.50	0.79	0.00	0.00
50.00	2.50	0.79	0.00	0.00

Summary for Subcatchment 2S: Developed (On Site)

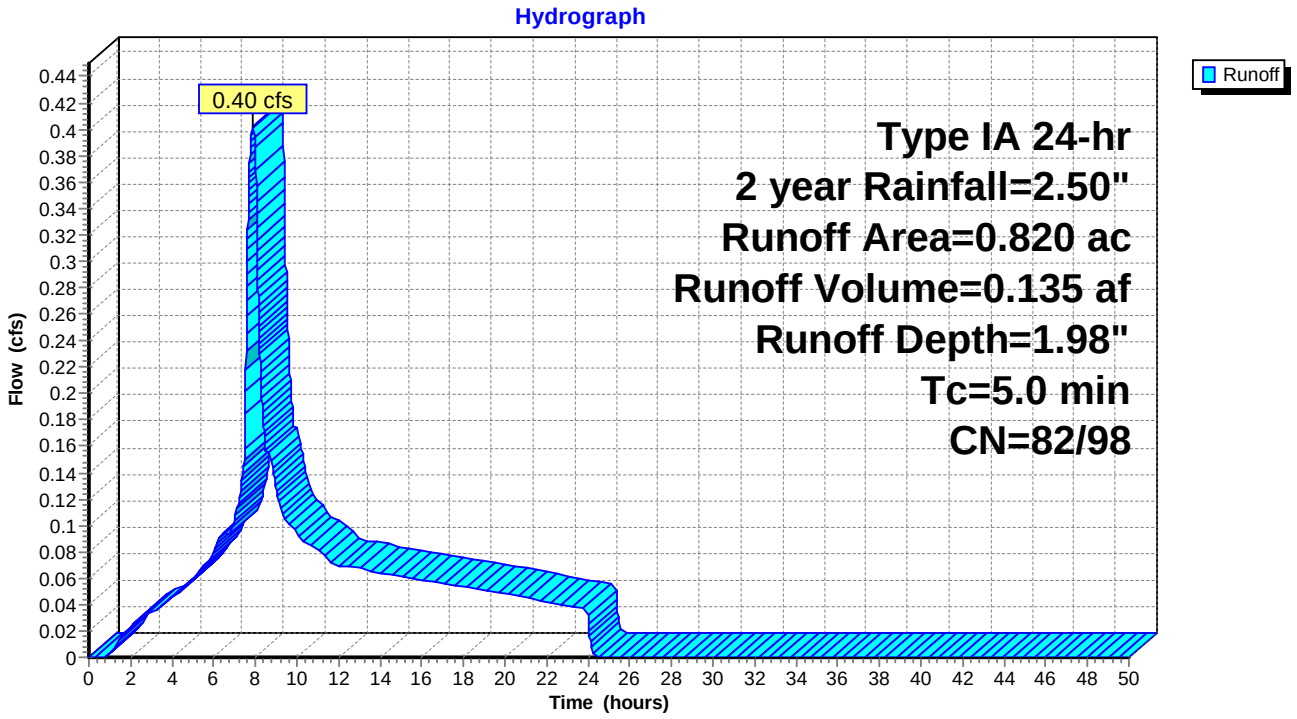
Runoff = 0.40 cfs @ 7.89 hrs, Volume= 0.135 af, Depth= 1.98"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 year Rainfall=2.50"

	Area (ac)	CN	Description
*	0.190	82	
*	0.630	98	
	0.820	94	Weighted Average
	0.190	82	23.17% Pervious Area
	0.630	98	76.83% Impervious Area

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

Subcatchment 2S: Developed (On Site)



Hydrograph for Subcatchment 2S: Developed (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00	0.00
1.00	0.05	0.00	0.00	0.00
1.50	0.09	0.00	0.01	0.01
2.00	0.13	0.00	0.02	0.02
2.50	0.16	0.00	0.05	0.03
3.00	0.20	0.00	0.07	0.03
3.50	0.25	0.00	0.10	0.04
4.00	0.29	0.00	0.14	0.05
4.50	0.34	0.00	0.18	0.05
5.00	0.39	0.00	0.22	0.06
5.50	0.45	0.00	0.27	0.07
6.00	0.51	0.00	0.33	0.08
6.50	0.59	0.01	0.40	0.10
7.00	0.67	0.02	0.48	0.10
7.50	0.78	0.04	0.57	**0.15**
8.00	1.06	0.14	0.85	**0.39**
8.50	1.20	0.20	0.99	0.16
9.00	1.30	0.24	1.08	0.13
9.50	1.37	0.28	1.16	0.10
10.00	1.44	0.31	1.22	0.09
10.50	1.50	0.35	1.28	0.09
11.00	1.56	0.38	1.34	0.08
11.50	1.61	0.41	1.39	0.07
12.00	1.66	0.44	1.44	0.07
12.50	1.71	0.46	1.48	0.07
13.00	1.75	0.49	1.53	0.07
13.50	1.80	0.52	1.57	0.07
14.00	1.84	0.55	1.62	0.06
14.50	1.88	0.57	1.66	0.06
15.00	1.92	0.60	1.70	0.06
15.50	1.96	0.62	1.74	0.06
16.00	2.00	0.65	1.78	0.06
16.50	2.04	0.68	1.81	0.06
17.00	2.08	0.70	1.85	0.06
17.50	2.11	0.73	1.89	0.05
18.00	2.15	0.75	1.92	0.05
18.50	2.18	0.77	1.96	0.05
19.00	2.22	0.80	1.99	0.05
19.50	2.25	0.82	2.02	0.05
20.00	2.28	0.84	2.05	0.05
20.50	2.31	0.86	2.08	0.05
21.00	2.34	0.88	2.11	0.05
21.50	2.37	0.90	2.14	0.04
22.00	2.40	0.92	2.17	0.04
22.50	2.43	0.94	2.20	0.04
23.00	2.45	0.96	2.22	0.04
23.50	2.48	0.98	2.25	0.04
24.00	**2.50**	**1.00**	**2.27**	0.04
24.50	2.50	1.00	2.27	0.00
25.00	2.50	1.00	2.27	0.00
25.50	2.50	1.00	2.27	0.00
26.00	2.50	1.00	2.27	0.00
26.50	2.50	1.00	2.27	0.00
27.00	2.50	1.00	2.27	0.00
27.50	2.50	1.00	2.27	0.00
28.00	2.50	1.00	2.27	0.00
28.50	2.50	1.00	2.27	0.00
29.00	2.50	1.00	2.27	0.00
29.50	2.50	1.00	2.27	0.00
30.00	2.50	1.00	2.27	0.00
30.50	2.50	1.00	2.27	0.00
31.00	2.50	1.00	2.27	0.00
31.50	2.50	1.00	2.27	0.00
32.00	2.50	1.00	2.27	0.00
32.50	2.50	1.00	2.27	0.00
33.00	2.50	1.00	2.27	0.00
33.50	2.50	1.00	2.27	0.00
34.00	2.50	1.00	2.27	0.00
34.50	2.50	1.00	2.27	0.00
35.00	2.50	1.00	2.27	0.00
35.50	2.50	1.00	2.27	0.00
36.00	2.50	1.00	2.27	0.00
36.50	2.50	1.00	2.27	0.00
37.00	2.50	1.00	2.27	0.00
37.50	2.50	1.00	2.27	0.00
38.00	2.50	1.00	2.27	0.00
38.50	2.50	1.00	2.27	0.00
39.00	2.50	1.00	2.27	0.00
39.50	2.50	1.00	2.27	0.00
40.00	2.50	1.00	2.27	0.00
40.50	2.50	1.00	2.27	0.00
41.00	2.50	1.00	2.27	0.00
41.50	2.50	1.00	2.27	0.00
42.00	2.50	1.00	2.27	0.00
42.50	2.50	1.00	2.27	0.00
43.00	2.50	1.00	2.27	0.00
43.50	2.50	1.00	2.27	0.00
44.00	2.50	1.00	2.27	0.00
44.50	2.50	1.00	2.27	0.00
45.00	2.50	1.00	2.27	0.00
45.50	2.50	1.00	2.27	0.00
46.00	2.50	1.00	2.27	0.00
46.50	2.50	1.00	2.27	0.00
47.00	2.50	1.00	2.27	0.00
47.50	2.50	1.00	2.27	0.00
48.00	2.50	1.00	2.27	0.00
48.50	2.50	1.00	2.27	0.00
49.00	2.50	1.00	2.27	0.00
49.50	2.50	1.00	2.27	0.00
50.00	2.50	1.00	2.27	0.00

Summary for Pond 3P: Detention Chambers

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.820 ac, 76.83% Impervious, Inflow Depth = 1.98" for 2 year event
Inflow = 0.40 cfs @ 7.89 hrs, Volume= 0.135 af
Outflow = 0.09 cfs @ 10.12 hrs, Volume= 0.135 af, Atten= 77%, Lag= 133.7 min
Primary = 0.09 cfs @ 10.12 hrs, Volume= 0.135 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 198.14' @ 10.12 hrs Surf.Area= 1,685 sf Storage= 1,686 cf

Plug-Flow detention time= 323.2 min calculated for 0.135 af (100% of inflow)
Center-of-Mass det. time= 323.2 min (1,014.7 - 691.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.58'	1,094 cf	**32.75'W x 51.46'L x 3.50'H Field A** 5,898 cf Overall - 2,251 cf Embedded = 3,647 cf x 30.0% Voids
#2A	197.08'	2,251 cf	**ADS_StormTech SC-740 +Cap** x 49 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 49 Chambers in 7 Rows
		3,345 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	195.96'	**12.0" Round Culvert** L= 31.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 195.96' / 195.65' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	193.96'	**1.2" Vert. Orifice/Grate** C= 0.600
#3	Device 1	198.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	198.86'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.09 cfs @ 10.12 hrs HW=198.14' (Free Discharge)
└**1=Culvert** (Passes 0.09 cfs of 5.34 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 7.11 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.04 cfs @ 1.26 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Detention Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

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

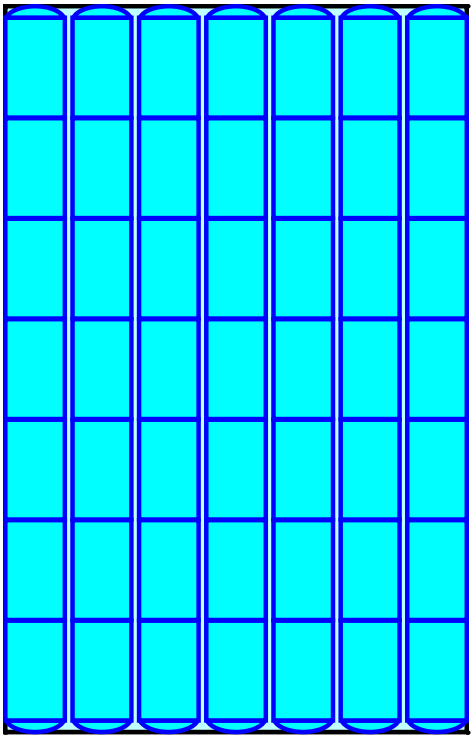
7 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 51.46' Row Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 = 32.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

49 Chambers x 45.9 cf = 2,251.1 cf Chamber Storage

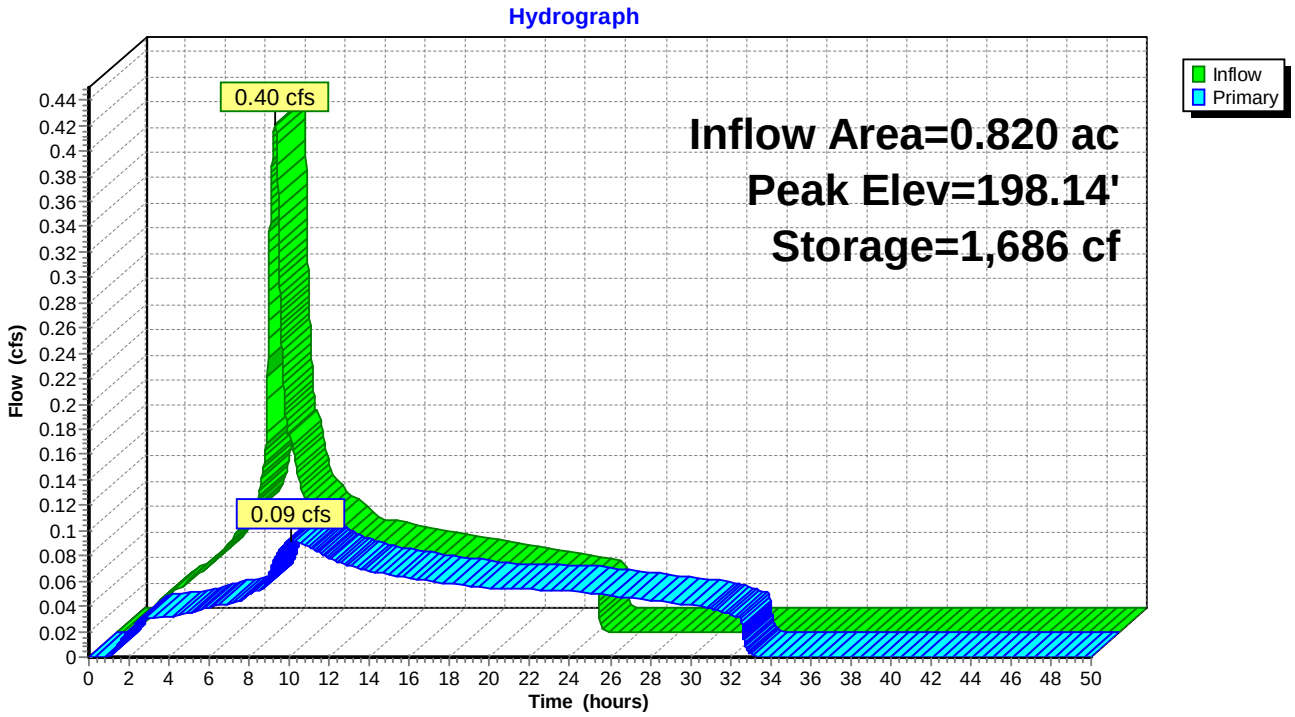
5,898.2 cf Field - 2,251.1 cf Chambers = 3,647.2 cf Stone x 30.0% Voids = 1,094.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,345.2 cf = 0.077 af
Overall Storage Efficiency = 56.7%
Overall System Size = 51.46' x 32.75' x 3.50'

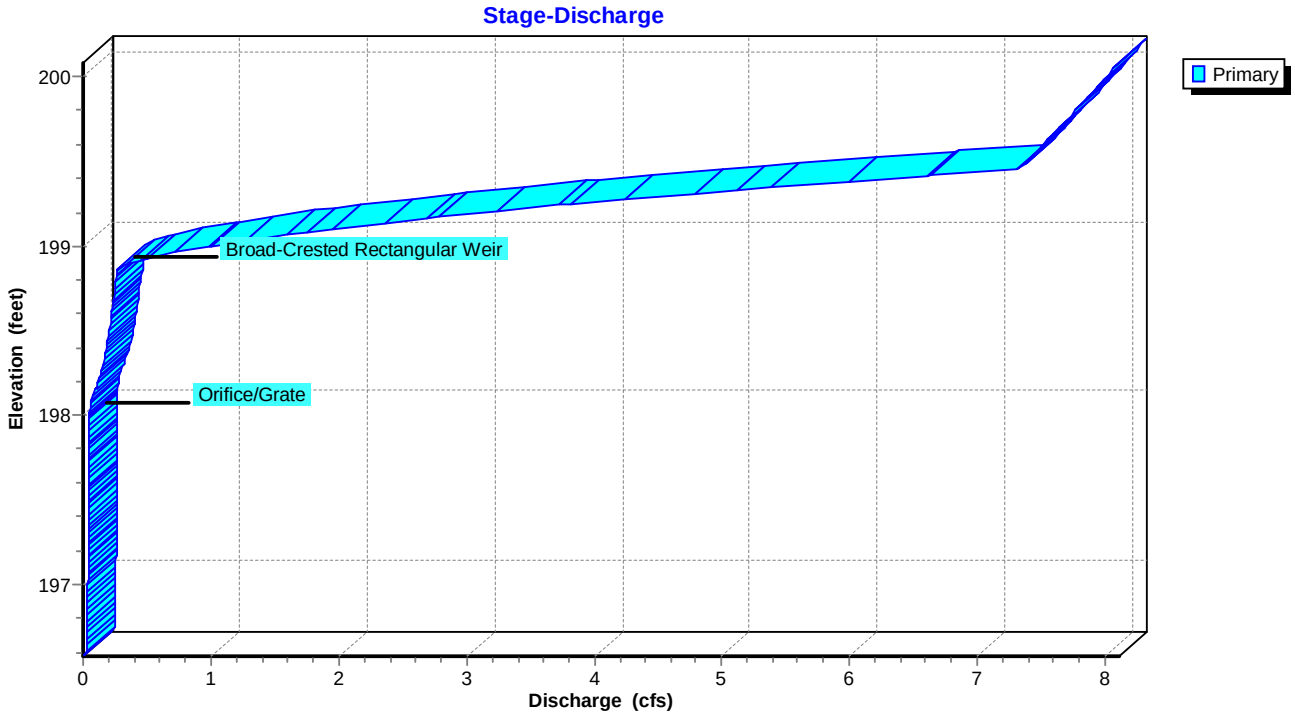
49 Chambers
218.5 cy Field
135.1 cy Stone



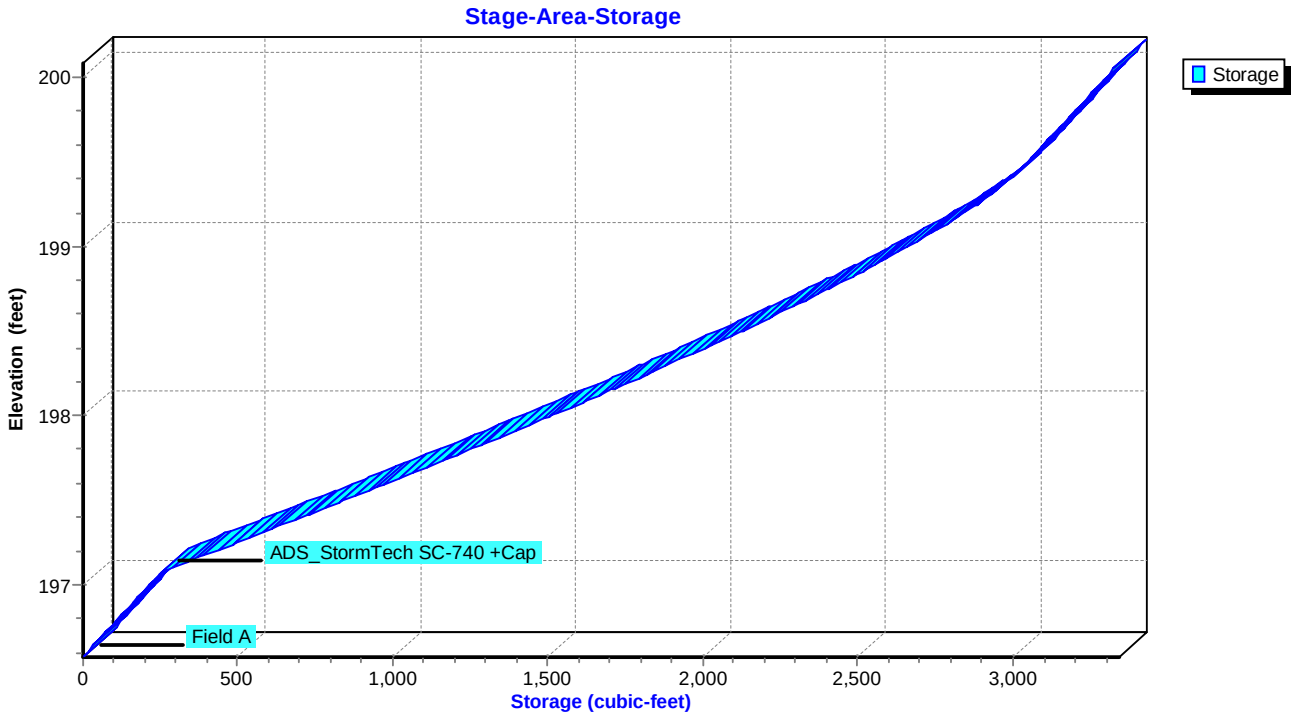
Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Hydrograph for Pond 3P: Detention Chambers

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	196.58	0.00
1.00	0.00	0	196.58	0.00
2.00	0.02	12	196.60	0.02
3.00	0.03	21	196.62	0.03
4.00	0.05	50	196.68	0.03
5.00	0.06	117	196.81	0.03
6.00	0.08	233	197.04	0.04
7.00	**0.10**	420	197.20	0.04
8.00	**0.39**	1,109	197.70	0.05
9.00	0.13	1,599	198.07	0.07
10.00	0.09	**1,685**	**198.14**	**0.09**
11.00	0.08	**1,675**	**198.13**	**0.09**
12.00	0.07	1,646	198.11	0.08
13.00	0.07	1,625	198.09	0.07
14.00	0.06	1,610	198.08	0.07
15.00	0.06	1,597	198.07	0.06
16.00	0.06	1,584	198.06	0.06
17.00	0.06	1,572	198.05	0.06
18.00	0.05	1,557	198.04	0.06
19.00	0.05	1,539	198.02	0.06
20.00	0.05	1,519	198.01	0.05
21.00	0.05	1,491	197.99	0.05
22.00	0.04	1,455	197.96	0.05
23.00	0.04	1,411	197.92	0.05
24.00	0.04	1,358	197.88	0.05
25.00	0.00	1,184	197.75	0.05
26.00	0.00	1,005	197.62	0.05
27.00	0.00	833	197.49	0.05
28.00	0.00	668	197.37	0.04
29.00	0.00	509	197.26	0.04
30.00	0.00	357	197.15	0.04
31.00	0.00	212	197.00	0.04
32.00	0.00	82	196.74	0.03
33.00	0.00	1	196.58	0.00
34.00	0.00	0	196.58	0.00
35.00	0.00	0	196.58	0.00
36.00	0.00	0	196.58	0.00
37.00	0.00	0	196.58	0.00
38.00	0.00	0	196.58	0.00
39.00	0.00	0	196.58	0.00
40.00	0.00	0	196.58	0.00
41.00	0.00	0	196.58	0.00
42.00	0.00	0	196.58	0.00
43.00	0.00	0	196.58	0.00
44.00	0.00	0	196.58	0.00
45.00	0.00	0	196.58	0.00
46.00	0.00	0	196.58	0.00
47.00	0.00	0	196.58	0.00
48.00	0.00	0	196.58	0.00
49.00	0.00	0	196.58	0.00
50.00	0.00	0	196.58	0.00

Stage-Discharge for Pond 3P: Detention Chambers

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
196.58	0.00	197.66	0.05	198.74	0.25	199.82	7.79
196.60	0.03	197.68	0.05	198.76	0.25	199.84	7.82
196.62	0.03	197.70	0.05	198.78	0.25	199.86	7.84
196.64	0.03	197.72	0.05	198.80	0.26	199.88	7.87
196.66	0.03	197.74	0.05	198.82	0.26	199.90	7.89
196.68	0.03	197.76	0.05	198.84	0.26	199.92	7.92
196.70	0.03	197.78	0.05	198.86	0.27	199.94	7.94
196.72	0.03	197.80	0.05	198.88	0.31	199.96	7.96
196.74	0.03	197.82	0.05	198.90	0.38	199.98	7.99
196.76	0.03	197.84	0.05	198.92	0.48	200.00	8.01
196.78	0.03	197.86	0.05	198.94	0.60	200.02	8.04
196.80	0.03	197.88	0.05	198.96	0.72	200.04	8.06
196.82	0.04	197.90	0.05	198.98	0.87	200.06	8.08
196.84	0.04	197.92	0.05	199.00	1.02	200.08	**8.11**
196.86	0.04	197.94	0.05	199.02	1.19		
196.88	0.04	197.96	0.05	199.04	1.36		
196.90	0.04	197.98	0.05	199.06	1.55		
196.92	0.04	198.00	0.05	199.08	1.75		
196.94	0.04	198.02	0.06	199.10	1.96		
196.96	0.04	198.04	0.06	199.12	2.18		
196.98	0.04	198.06	0.06	199.14	2.42		
197.00	0.04	198.08	0.07	199.16	2.66		
197.02	0.04	198.10	0.08	199.18	2.91		
197.04	0.04	198.12	0.08	199.20	3.17		
197.06	0.04	198.14	0.09	199.22	3.44		
197.08	0.04	198.16	0.10	199.24	3.72		
197.10	0.04	198.18	0.11	199.26	4.01		
197.12	0.04	198.20	0.12	199.28	4.32		
197.14	0.04	198.22	0.13	199.30	4.63		
197.16	0.04	198.24	0.14	199.32	4.96		
197.18	0.04	198.26	0.14	199.34	5.29		
197.20	0.04	198.28	0.15	199.36	5.64		
197.22	0.04	198.30	0.16	199.38	5.99		
197.24	0.04	198.32	0.16	199.40	6.35		
197.26	0.04	198.34	0.17	199.42	6.73		
197.28	0.04	198.36	0.17	199.44	7.11		
197.30	0.04	198.38	0.18	199.46	7.34		
197.32	0.04	198.40	0.18	199.48	7.36		
197.34	0.04	198.42	0.19	199.50	7.39		
197.36	0.04	198.44	0.19	199.52	7.42		
197.38	0.05	198.46	0.20	199.54	7.44		
197.40	0.05	198.48	0.20	199.56	7.47		
197.42	0.05	198.50	0.21	199.58	7.49		
197.44	0.05	198.52	0.21	199.60	7.52		
197.46	0.05	198.54	0.21	199.62	7.54		
197.48	0.05	198.56	0.22	199.64	7.57		
197.50	0.05	198.58	0.22	199.66	7.59		
197.52	0.05	198.60	0.22	199.68	7.62		
197.54	0.05	198.62	0.23	199.70	7.64		
197.56	0.05	198.64	0.23	199.72	7.67		
197.58	0.05	198.66	0.24	199.74	7.69		
197.60	0.05	198.68	0.24	199.76	7.72		
197.62	0.05	198.70	0.24	199.78	7.74		
197.64	0.05	198.72	0.25	199.80	7.77		

Stage-Area-Storage for Pond 3P: Detention Chambers

Elevation (feet)	Storage (cubic-feet)
196.58	0
196.63	25
196.68	51
196.73	76
196.78	101
196.83	126
196.88	152
196.93	177
196.98	202
197.03	228
197.08	253
197.13	323
197.18	394
197.23	465
197.28	535
197.33	605
197.38	675
197.43	744
197.48	813
197.53	882
197.58	950
197.63	1,019
197.68	1,086
197.73	1,154
197.78	1,220
197.83	1,287
197.88	1,353
197.93	1,418
197.98	1,484
198.03	1,548
198.08	1,612
198.13	1,676
198.18	1,739
198.23	1,801
198.28	1,863
198.33	1,924
198.38	1,985
198.43	2,044
198.48	2,104
198.53	2,162
198.58	2,220
198.63	2,276
198.68	2,332
198.73	2,387
198.78	2,441
198.83	2,494
198.88	2,546
198.93	2,596
198.98	2,646
199.03	2,694
199.08	2,741
199.13	2,786
199.18	2,830
199.23	2,872
199.28	2,911
199.33	2,947
199.38	2,980
199.43	3,010
199.48	3,039
199.53	3,066
199.58	3,092
199.63	3,118
199.68	3,143
199.73	3,168
199.78	3,194
199.83	3,219
199.88	3,244
199.93	3,269
199.98	3,295
200.03	3,320
200.08	**3,345**

Time span=0.00-50.00 hrs, dt=0.01 hrs, 5001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Predeveloped (On Site) Runoff Area=0.820 ac 0.00% Impervious Runoff Depth=1.13"
Tc=16.4 min CN=78/0 Runoff=0.16 cfs 0.077 af

Subcatchment 2S: Developed (On Site) Runoff Area=0.820 ac 76.83% Impervious Runoff Depth=2.45"
Tc=5.0 min CN=82/98 Runoff=0.50 cfs 0.167 af

Pond 3P: Detention Chambers Peak Elev=198.31' Storage=1,895 cf Inflow=0.50 cfs 0.167 af
Outflow=0.16 cfs 0.167 af

Total Runoff Area = 1.640 ac Runoff Volume = 0.244 af Average Runoff Depth = 1.79"
61.59% Pervious = 1.010 ac 38.41% Impervious = 0.630 ac

Summary for Subcatchment 1S: Predeveloped (On Site)

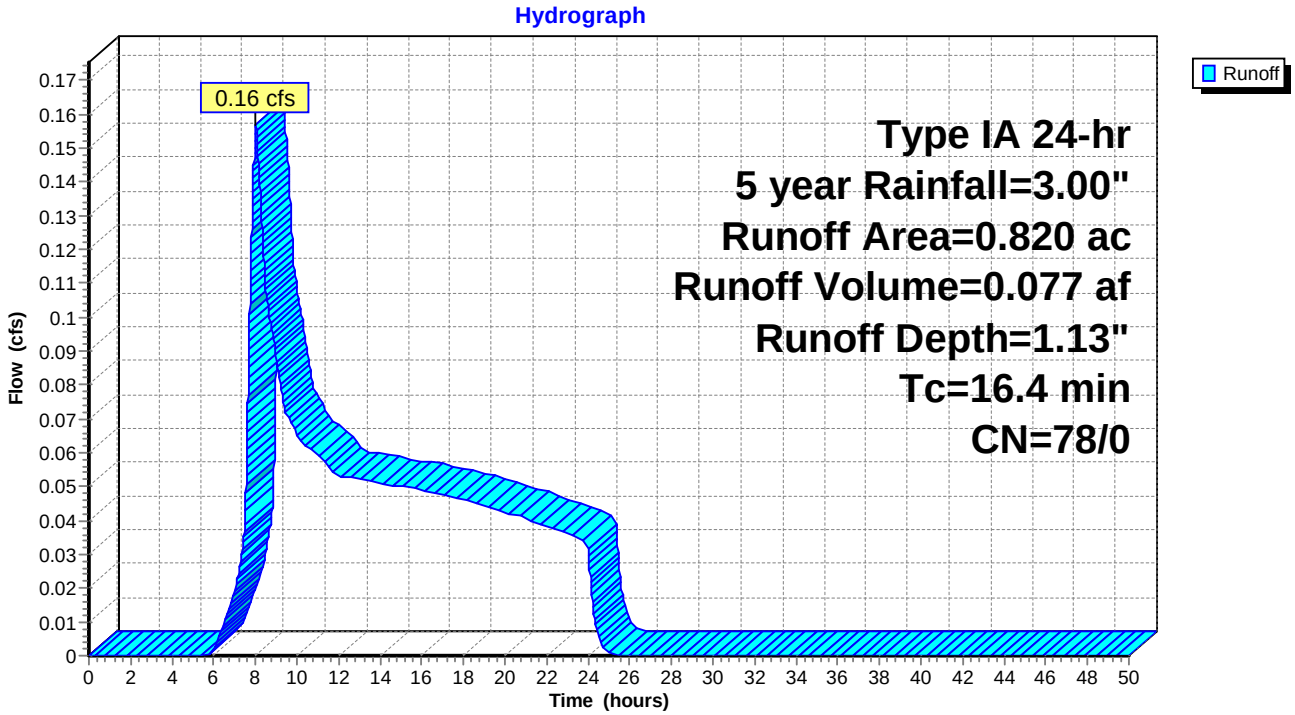
Runoff = 0.16 cfs @ 8.01 hrs, Volume= 0.077 af, Depth= 1.13"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5 year Rainfall=3.00"

	Area (ac)	CN	Description
*	0.820	78	
	0.820	78	100.00% Pervious Area

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

Subcatchment 1S: Predeveloped (On Site)



Hydrograph for Subcatchment 1S: Predeveloped (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
0.50	0.03	0.00	0.00	0.00
1.00	0.06	0.00	0.00	0.00
1.50	0.10	0.00	0.00	0.00
2.00	0.15	0.00	0.00	0.00
2.50	0.20	0.00	0.00	0.00
3.00	0.25	0.00	0.00	0.00
3.50	0.29	0.00	0.00	0.00
4.00	0.35	0.00	0.00	0.00
4.50	0.40	0.00	0.00	0.00
5.00	0.47	0.00	0.00	0.00
5.50	0.54	0.00	0.00	0.00
6.00	0.62	0.00	0.00	0.00
6.50	0.71	0.01	0.00	0.01
7.00	0.80	0.02	0.00	0.02
7.50	0.93	0.04	0.00	0.04
8.00	1.28	0.14	0.00	**0.16**
8.50	1.44	0.21	0.00	**0.11**
9.00	1.56	0.26	0.00	0.09
9.50	1.65	0.30	0.00	0.07
10.00	1.73	0.34	0.00	0.07
10.50	1.80	0.38	0.00	0.06
11.00	1.87	0.41	0.00	0.06
11.50	1.94	0.45	0.00	0.06
12.00	1.99	0.48	0.00	0.05
12.50	2.05	0.51	0.00	0.05
13.00	2.10	0.54	0.00	0.05
13.50	2.16	0.57	0.00	0.05
14.00	2.21	0.61	0.00	0.05
14.50	2.26	0.64	0.00	0.05
15.00	2.31	0.67	0.00	0.05
15.50	2.36	0.70	0.00	0.05
16.00	2.40	0.73	0.00	0.05
16.50	2.45	0.75	0.00	0.05
17.00	2.49	0.78	0.00	0.05
17.50	2.54	0.81	0.00	0.05
18.00	2.58	0.84	0.00	0.05
18.50	2.62	0.87	0.00	0.05
19.00	2.66	0.89	0.00	0.04
19.50	2.70	0.92	0.00	0.04
20.00	2.74	0.95	0.00	0.04
20.50	2.77	0.97	0.00	0.04
21.00	2.81	1.00	0.00	0.04
21.50	2.84	1.02	0.00	0.04
22.00	2.88	1.04	0.00	0.04
22.50	2.91	1.07	0.00	0.04
23.00	2.94	1.09	0.00	0.04
23.50	2.97	1.11	0.00	0.04
24.00	**3.00**	**1.13**	0.00	0.03
24.50	3.00	1.13	0.00	0.01
25.00	3.00	1.13	0.00	0.00
25.50	3.00	1.13	0.00	0.00
26.00	3.00	1.13	0.00	0.00
26.50	3.00	1.13	0.00	0.00
27.00	3.00	1.13	0.00	0.00
27.50	3.00	1.13	0.00	0.00
28.00	3.00	1.13	0.00	0.00
28.50	3.00	1.13	0.00	0.00
29.00	3.00	1.13	0.00	0.00
29.50	3.00	1.13	0.00	0.00
30.00	3.00	1.13	0.00	0.00
30.50	3.00	1.13	0.00	0.00
31.00	3.00	1.13	0.00	0.00
31.50	3.00	1.13	0.00	0.00
32.00	3.00	1.13	0.00	0.00
32.50	3.00	1.13	0.00	0.00
33.00	3.00	1.13	0.00	0.00
33.50	3.00	1.13	0.00	0.00
34.00	3.00	1.13	0.00	0.00
34.50	3.00	1.13	0.00	0.00
35.00	3.00	1.13	0.00	0.00
35.50	3.00	1.13	0.00	0.00
36.00	3.00	1.13	0.00	0.00
36.50	3.00	1.13	0.00	0.00
37.00	3.00	1.13	0.00	0.00
37.50	3.00	1.13	0.00	0.00
38.00	3.00	1.13	0.00	0.00
38.50	3.00	1.13	0.00	0.00
39.00	3.00	1.13	0.00	0.00
39.50	3.00	1.13	0.00	0.00
40.00	3.00	1.13	0.00	0.00
40.50	3.00	1.13	0.00	0.00
41.00	3.00	1.13	0.00	0.00
41.50	3.00	1.13	0.00	0.00
42.00	3.00	1.13	0.00	0.00
42.50	3.00	1.13	0.00	0.00
43.00	3.00	1.13	0.00	0.00
43.50	3.00	1.13	0.00	0.00
44.00	3.00	1.13	0.00	0.00
44.50	3.00	1.13	0.00	0.00
45.00	3.00	1.13	0.00	0.00
45.50	3.00	1.13	0.00	0.00
46.00	3.00	1.13	0.00	0.00
46.50	3.00	1.13	0.00	0.00
47.00	3.00	1.13	0.00	0.00
47.50	3.00	1.13	0.00	0.00
48.00	3.00	1.13	0.00	0.00
48.50	3.00	1.13	0.00	0.00
49.00	3.00	1.13	0.00	0.00
49.50	3.00	1.13	0.00	0.00
50.00	3.00	1.13	0.00	0.00

Summary for Subcatchment 2S: Developed (On Site)

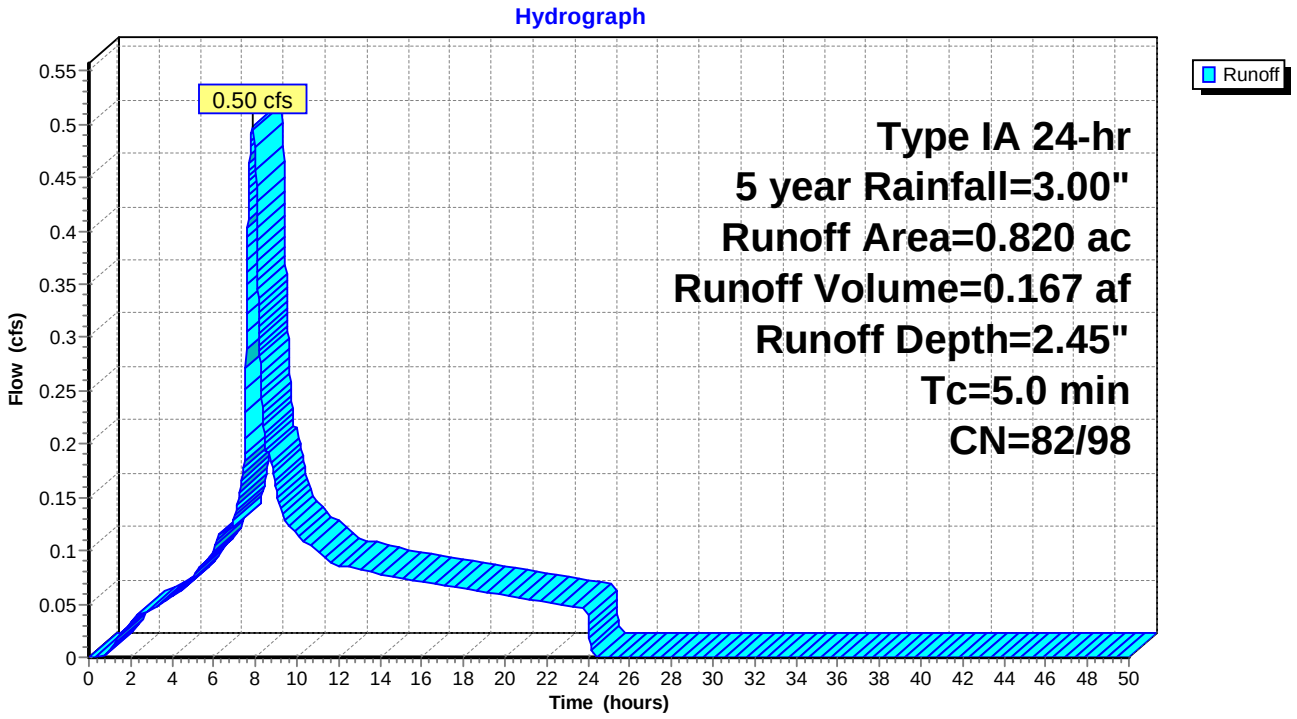
Runoff = 0.50 cfs @ 7.89 hrs, Volume= 0.167 af, Depth= 2.45"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 5 year Rainfall=3.00"

	Area (ac)	CN	Description
*	0.190	82	
*	0.630	98	
	0.820	94	Weighted Average
	0.190	82	23.17% Pervious Area
	0.630	98	76.83% Impervious Area

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

Subcatchment 2S: Developed (On Site)



Hydrograph for Subcatchment 2S: Developed (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00	0.00
1.00	0.06	0.00	0.00	0.01
1.50	0.10	0.00	0.02	0.02
2.00	0.15	0.00	0.04	0.03
2.50	0.20	0.00	0.07	0.04
3.00	0.25	0.00	0.10	0.05
3.50	0.29	0.00	0.14	0.05
4.00	0.35	0.00	0.18	0.06
4.50	0.40	0.00	0.23	0.06
5.00	0.47	0.00	0.29	0.07
5.50	0.54	0.00	0.35	0.09
6.00	0.62	0.01	0.43	0.10
6.50	0.71	0.03	0.51	0.12
7.00	0.80	0.05	0.60	0.13
7.50	0.93	0.09	0.72	**0.19**
8.00	1.28	0.23	1.06	**0.48**
8.50	1.44	0.31	1.22	0.19
9.00	1.56	0.38	1.34	0.16
9.50	1.65	0.43	1.43	0.12
10.00	1.73	0.48	1.51	0.12
10.50	1.80	0.52	1.58	0.10
11.00	1.87	0.57	1.65	0.10
11.50	1.94	0.61	1.71	0.09
12.00	1.99	0.64	1.77	0.08
12.50	2.05	0.68	1.82	0.09
13.00	2.10	0.72	1.88	0.08
13.50	2.16	0.75	1.93	0.08
14.00	2.21	0.79	1.98	0.08
14.50	2.26	0.82	2.03	0.08
15.00	2.31	0.86	2.08	0.07
15.50	2.36	0.89	2.13	0.07
16.00	2.40	0.93	2.17	0.07
16.50	2.45	0.96	2.22	0.07
17.00	2.49	0.99	2.26	0.07
17.50	2.54	1.03	2.31	0.07
18.00	2.58	1.06	2.35	0.07
18.50	2.62	1.09	2.39	0.06
19.00	2.66	1.12	2.43	0.06
19.50	2.70	1.15	2.47	0.06
20.00	2.74	1.18	2.51	0.06
20.50	2.77	1.20	2.54	0.06
21.00	2.81	1.23	2.58	0.05
21.50	2.84	1.26	2.61	0.05
22.00	2.88	1.28	2.65	0.05
22.50	2.91	1.31	2.68	0.05
23.00	2.94	1.33	2.71	0.05
23.50	2.97	1.36	2.74	0.05
24.00	**3.00**	**1.38**	**2.77**	0.04
24.50	3.00	1.38	2.77	0.00
25.00	3.00	1.38	2.77	0.00
25.50	3.00	1.38	2.77	0.00
26.00	3.00	1.38	2.77	0.00
26.50	3.00	1.38	2.77	0.00
27.00	3.00	1.38	2.77	0.00
27.50	3.00	1.38	2.77	0.00
28.00	3.00	1.38	2.77	0.00
28.50	3.00	1.38	2.77	0.00
29.00	3.00	1.38	2.77	0.00
29.50	3.00	1.38	2.77	0.00
30.00	3.00	1.38	2.77	0.00
30.50	3.00	1.38	2.77	0.00
31.00	3.00	1.38	2.77	0.00
31.50	3.00	1.38	2.77	0.00
32.00	3.00	1.38	2.77	0.00
32.50	3.00	1.38	2.77	0.00
33.00	3.00	1.38	2.77	0.00
33.50	3.00	1.38	2.77	0.00
34.00	3.00	1.38	2.77	0.00
34.50	3.00	1.38	2.77	0.00
35.00	3.00	1.38	2.77	0.00
35.50	3.00	1.38	2.77	0.00
36.00	3.00	1.38	2.77	0.00
36.50	3.00	1.38	2.77	0.00
37.00	3.00	1.38	2.77	0.00
37.50	3.00	1.38	2.77	0.00
38.00	3.00	1.38	2.77	0.00
38.50	3.00	1.38	2.77	0.00
39.00	3.00	1.38	2.77	0.00
39.50	3.00	1.38	2.77	0.00
40.00	3.00	1.38	2.77	0.00
40.50	3.00	1.38	2.77	0.00
41.00	3.00	1.38	2.77	0.00
41.50	3.00	1.38	2.77	0.00
42.00	3.00	1.38	2.77	0.00
42.50	3.00	1.38	2.77	0.00
43.00	3.00	1.38	2.77	0.00
43.50	3.00	1.38	2.77	0.00
44.00	3.00	1.38	2.77	0.00
44.50	3.00	1.38	2.77	0.00
45.00	3.00	1.38	2.77	0.00
45.50	3.00	1.38	2.77	0.00
46.00	3.00	1.38	2.77	0.00
46.50	3.00	1.38	2.77	0.00
47.00	3.00	1.38	2.77	0.00
47.50	3.00	1.38	2.77	0.00
48.00	3.00	1.38	2.77	0.00
48.50	3.00	1.38	2.77	0.00
49.00	3.00	1.38	2.77	0.00
49.50	3.00	1.38	2.77	0.00
50.00	3.00	1.38	2.77	0.00

Summary for Pond 3P: Detention Chambers

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.820 ac, 76.83% Impervious, Inflow Depth = 2.45" for 5 year event
Inflow = 0.50 cfs @ 7.89 hrs, Volume= 0.167 af
Outflow = 0.16 cfs @ 9.00 hrs, Volume= 0.167 af, Atten= 68%, Lag= 66.5 min
Primary = 0.16 cfs @ 9.00 hrs, Volume= 0.167 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 198.31' @ 9.00 hrs Surf.Area= 1,685 sf Storage= 1,895 cf

Plug-Flow detention time= 289.2 min calculated for 0.167 af (100% of inflow)
Center-of-Mass det. time= 289.2 min (975.4 - 686.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.58'	1,094 cf	**32.75'W x 51.46'L x 3.50'H Field A** 5,898 cf Overall - 2,251 cf Embedded = 3,647 cf x 30.0% Voids
#2A	197.08'	2,251 cf	**ADS_StormTech SC-740 +Cap** x 49 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 49 Chambers in 7 Rows
		3,345 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	195.96'	**12.0" Round Culvert** L= 31.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 195.96' / 195.65' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	193.96'	**1.2" Vert. Orifice/Grate** C= 0.600
#3	Device 1	198.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	198.86'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.16 cfs @ 9.00 hrs HW=198.31' (Free Discharge)
└**1=Culvert** (Passes 0.16 cfs of 5.63 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 7.38 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.10 cfs @ 2.05 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Detention Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

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

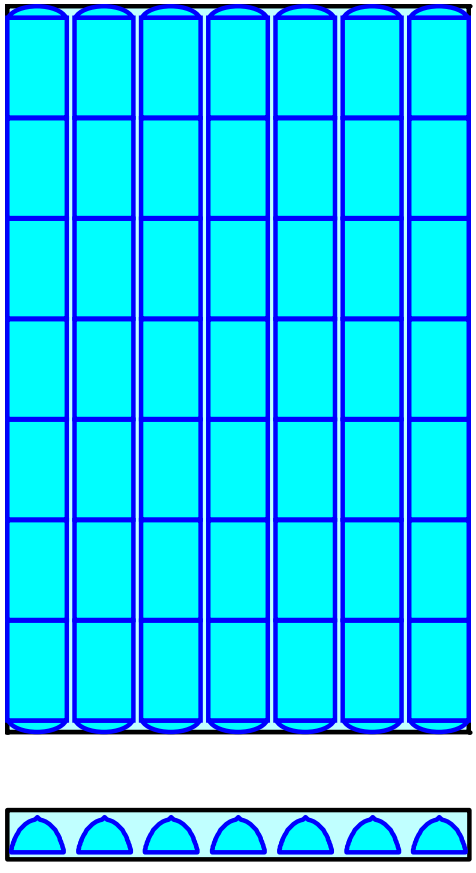
7 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 51.46' Row Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 = 32.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

49 Chambers x 45.9 cf = 2,251.1 cf Chamber Storage

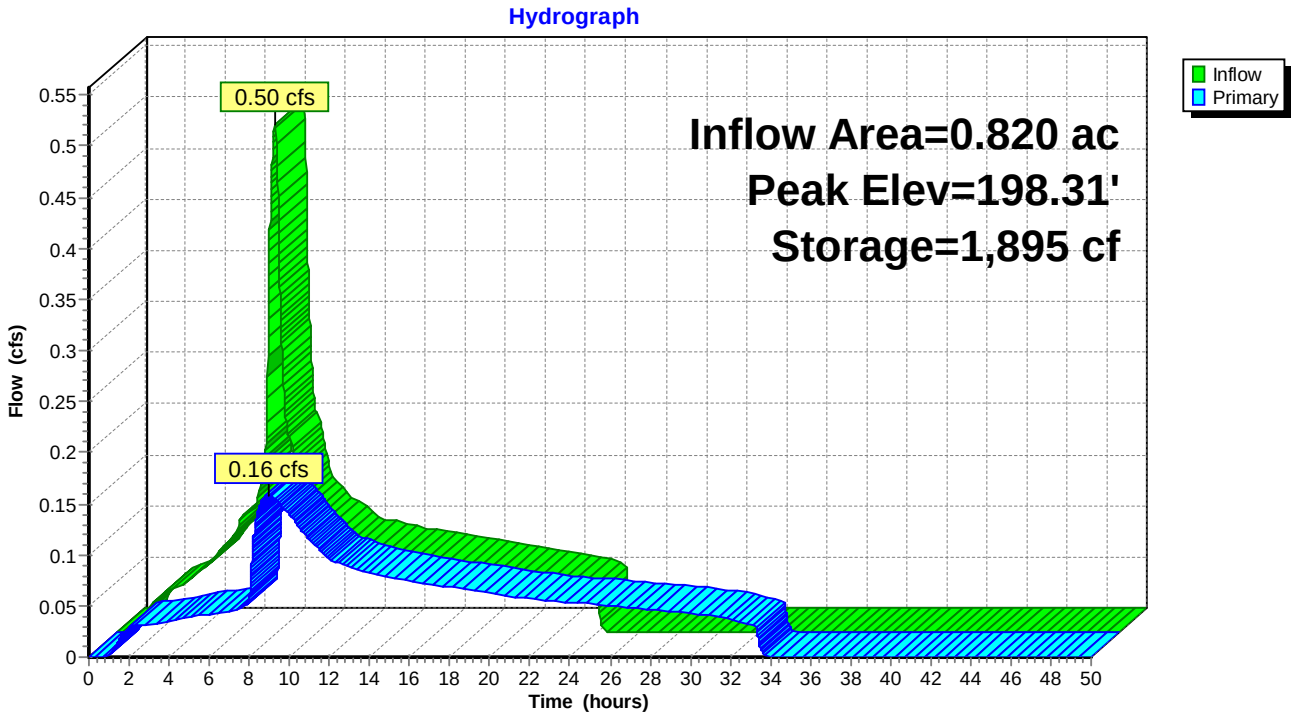
5,898.2 cf Field - 2,251.1 cf Chambers = 3,647.2 cf Stone x 30.0% Voids = 1,094.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,345.2 cf = 0.077 af
Overall Storage Efficiency = 56.7%
Overall System Size = 51.46' x 32.75' x 3.50'

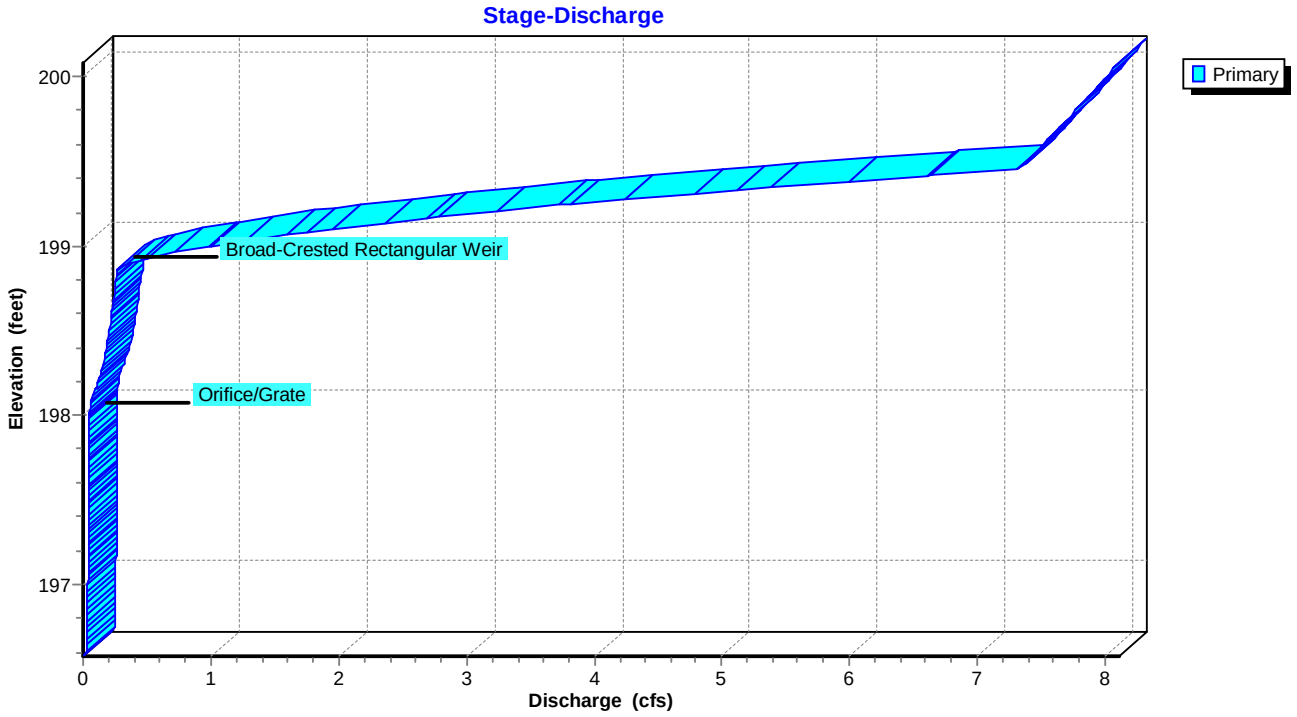
49 Chambers
218.5 cy Field
135.1 cy Stone



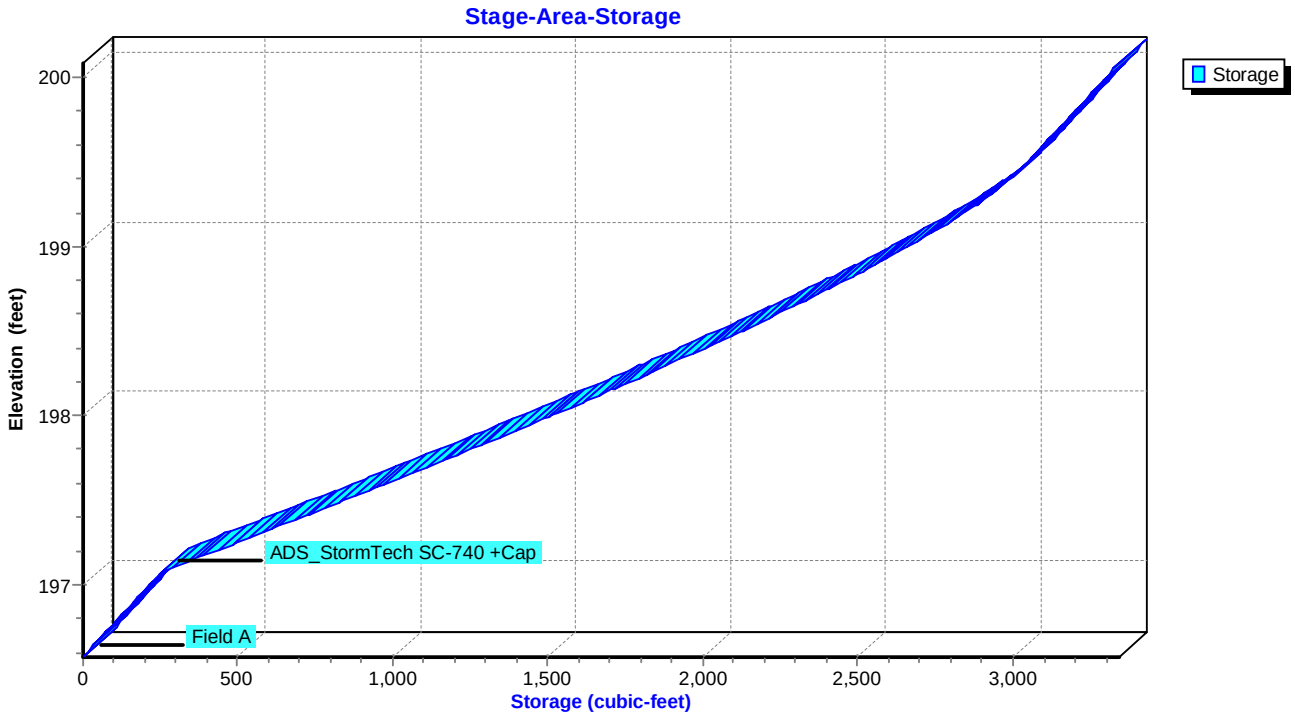
Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Hydrograph for Pond 3P: Detention Chambers

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	196.58	0.00
1.00	0.01	1	196.58	0.00
2.00	0.03	17	196.61	0.03
3.00	0.05	49	196.68	0.03
4.00	0.06	112	196.80	0.03
5.00	0.07	214	197.00	0.04
6.00	0.10	384	197.17	0.04
7.00	**0.13**	648	197.36	0.04
8.00	**0.48**	1,531	198.02	0.05
9.00	0.16	**1,895**	**198.31**	**0.16**
10.00	0.12	1,822	198.25	0.14
11.00	0.10	1,750	198.19	0.12
12.00	0.08	1,700	198.15	0.10
13.00	0.08	1,675	198.13	0.09
14.00	0.08	1,659	198.12	0.08
15.00	0.07	1,647	198.11	0.08
16.00	0.07	1,636	198.10	0.07
17.00	0.07	1,625	198.09	0.07
18.00	0.07	1,613	198.08	0.07
19.00	0.06	1,601	198.07	0.07
20.00	0.06	1,586	198.06	0.06
21.00	0.05	1,571	198.05	0.06
22.00	0.05	1,551	198.03	0.06
23.00	0.05	1,529	198.01	0.05
24.00	0.04	1,500	197.99	0.05
25.00	0.00	1,323	197.86	0.05
26.00	0.00	1,139	197.72	0.05
27.00	0.00	962	197.59	0.05
28.00	0.00	791	197.46	0.05
29.00	0.00	628	197.35	0.04
30.00	0.00	471	197.23	0.04
31.00	0.00	320	197.13	0.04
32.00	0.00	178	196.93	0.04
33.00	0.00	53	196.69	0.03
34.00	0.00	0	196.58	0.00
35.00	0.00	0	196.58	0.00
36.00	0.00	0	196.58	0.00
37.00	0.00	0	196.58	0.00
38.00	0.00	0	196.58	0.00
39.00	0.00	0	196.58	0.00
40.00	0.00	0	196.58	0.00
41.00	0.00	0	196.58	0.00
42.00	0.00	0	196.58	0.00
43.00	0.00	0	196.58	0.00
44.00	0.00	0	196.58	0.00
45.00	0.00	0	196.58	0.00
46.00	0.00	0	196.58	0.00
47.00	0.00	0	196.58	0.00
48.00	0.00	0	196.58	0.00
49.00	0.00	0	196.58	0.00
50.00	0.00	0	196.58	0.00

Stage-Discharge for Pond 3P: Detention Chambers

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
196.58	0.00	197.66	0.05	198.74	0.25	199.82	7.79
196.60	0.03	197.68	0.05	198.76	0.25	199.84	7.82
196.62	0.03	197.70	0.05	198.78	0.25	199.86	7.84
196.64	0.03	197.72	0.05	198.80	0.26	199.88	7.87
196.66	0.03	197.74	0.05	198.82	0.26	199.90	7.89
196.68	0.03	197.76	0.05	198.84	0.26	199.92	7.92
196.70	0.03	197.78	0.05	198.86	0.27	199.94	7.94
196.72	0.03	197.80	0.05	198.88	0.31	199.96	7.96
196.74	0.03	197.82	0.05	198.90	0.38	199.98	7.99
196.76	0.03	197.84	0.05	198.92	0.48	200.00	8.01
196.78	0.03	197.86	0.05	198.94	0.60	200.02	8.04
196.80	0.03	197.88	0.05	198.96	0.72	200.04	8.06
196.82	0.04	197.90	0.05	198.98	0.87	200.06	8.08
196.84	0.04	197.92	0.05	199.00	1.02	200.08	**8.11**
196.86	0.04	197.94	0.05	199.02	1.19		
196.88	0.04	197.96	0.05	199.04	1.36		
196.90	0.04	197.98	0.05	199.06	1.55		
196.92	0.04	198.00	0.05	199.08	1.75		
196.94	0.04	198.02	0.06	199.10	1.96		
196.96	0.04	198.04	0.06	199.12	2.18		
196.98	0.04	198.06	0.06	199.14	2.42		
197.00	0.04	198.08	0.07	199.16	2.66		
197.02	0.04	198.10	0.08	199.18	2.91		
197.04	0.04	198.12	0.08	199.20	3.17		
197.06	0.04	198.14	0.09	199.22	3.44		
197.08	0.04	198.16	0.10	199.24	3.72		
197.10	0.04	198.18	0.11	199.26	4.01		
197.12	0.04	198.20	0.12	199.28	4.32		
197.14	0.04	198.22	0.13	199.30	4.63		
197.16	0.04	198.24	0.14	199.32	4.96		
197.18	0.04	198.26	0.14	199.34	5.29		
197.20	0.04	198.28	0.15	199.36	5.64		
197.22	0.04	198.30	0.16	199.38	5.99		
197.24	0.04	198.32	0.16	199.40	6.35		
197.26	0.04	198.34	0.17	199.42	6.73		
197.28	0.04	198.36	0.17	199.44	7.11		
197.30	0.04	198.38	0.18	199.46	7.34		
197.32	0.04	198.40	0.18	199.48	7.36		
197.34	0.04	198.42	0.19	199.50	7.39		
197.36	0.04	198.44	0.19	199.52	7.42		
197.38	0.05	198.46	0.20	199.54	7.44		
197.40	0.05	198.48	0.20	199.56	7.47		
197.42	0.05	198.50	0.21	199.58	7.49		
197.44	0.05	198.52	0.21	199.60	7.52		
197.46	0.05	198.54	0.21	199.62	7.54		
197.48	0.05	198.56	0.22	199.64	7.57		
197.50	0.05	198.58	0.22	199.66	7.59		
197.52	0.05	198.60	0.22	199.68	7.62		
197.54	0.05	198.62	0.23	199.70	7.64		
197.56	0.05	198.64	0.23	199.72	7.67		
197.58	0.05	198.66	0.24	199.74	7.69		
197.60	0.05	198.68	0.24	199.76	7.72		
197.62	0.05	198.70	0.24	199.78	7.74		
197.64	0.05	198.72	0.25	199.80	7.77		

Stage-Area-Storage for Pond 3P: Detention Chambers

Elevation (feet)	Storage (cubic-feet)
196.58	0
196.63	25
196.68	51
196.73	76
196.78	101
196.83	126
196.88	152
196.93	177
196.98	202
197.03	228
197.08	253
197.13	323
197.18	394
197.23	465
197.28	535
197.33	605
197.38	675
197.43	744
197.48	813
197.53	882
197.58	950
197.63	1,019
197.68	1,086
197.73	1,154
197.78	1,220
197.83	1,287
197.88	1,353
197.93	1,418
197.98	1,484
198.03	1,548
198.08	1,612
198.13	1,676
198.18	1,739
198.23	1,801
198.28	1,863
198.33	1,924
198.38	1,985
198.43	2,044
198.48	2,104
198.53	2,162
198.58	2,220
198.63	2,276
198.68	2,332
198.73	2,387
198.78	2,441
198.83	2,494
198.88	2,546
198.93	2,596
198.98	2,646
199.03	2,694
199.08	2,741
199.13	2,786
199.18	2,830
199.23	2,872
199.28	2,911
199.33	2,947
199.38	2,980
199.43	3,010
199.48	3,039
199.53	3,066
199.58	3,092
199.63	3,118
199.68	3,143
199.73	3,168
199.78	3,194
199.83	3,219
199.88	3,244
199.93	3,269
199.98	3,295
200.03	3,320
200.08	**3,345**

Time span=0.00-50.00 hrs, dt=0.01 hrs, 5001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Predeveloped (On Site) Runoff Area=0.820 ac 0.00% Impervious Runoff Depth=1.50"
Tc=16.4 min CN=78/0 Runoff=0.23 cfs 0.102 af

Subcatchment 2S: Developed (On Site) Runoff Area=0.820 ac 76.83% Impervious Runoff Depth=2.92"
Tc=5.0 min CN=82/98 Runoff=0.59 cfs 0.200 af

Pond 3P: Detention Chambers Peak Elev=198.56' Storage=2,199 cf Inflow=0.59 cfs 0.200 af
Outflow=0.22 cfs 0.200 af

Total Runoff Area = 1.640 ac Runoff Volume = 0.302 af Average Runoff Depth = 2.21"
61.59% Pervious = 1.010 ac 38.41% Impervious = 0.630 ac

Summary for Subcatchment 1S: Predeveloped (On Site)

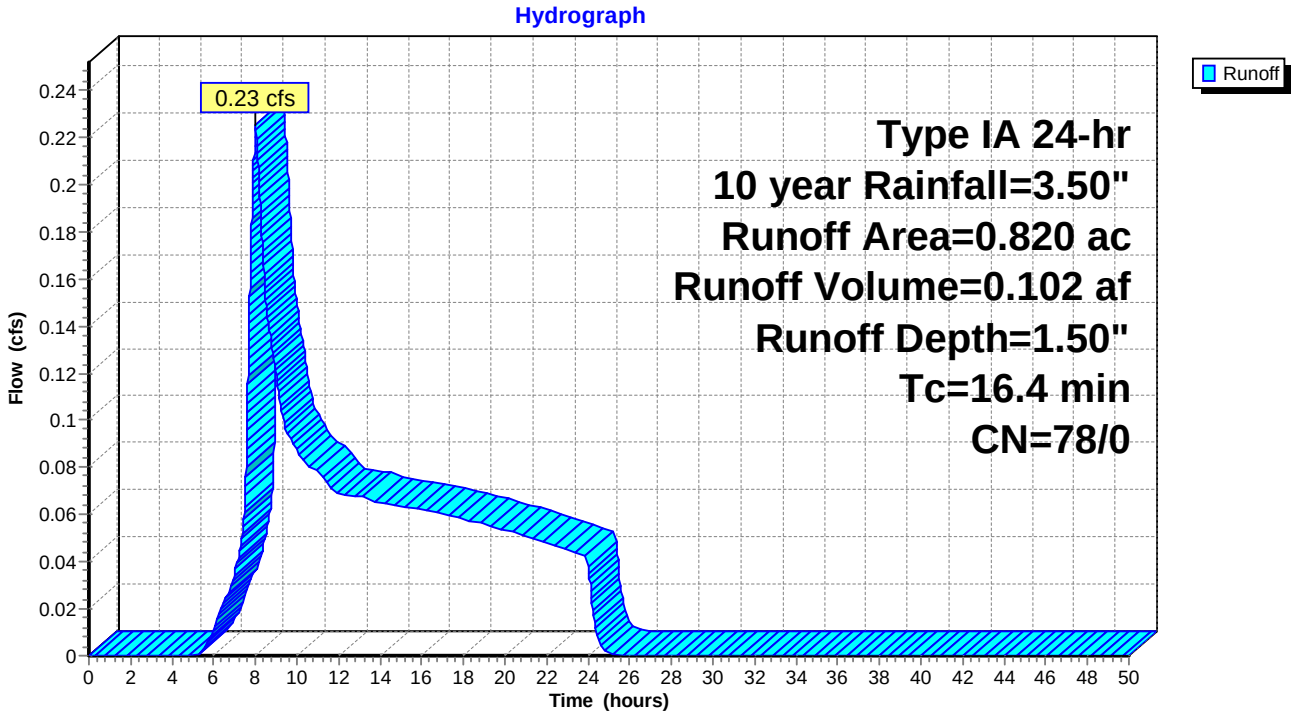
Runoff = 0.23 cfs @ 8.01 hrs, Volume= 0.102 af, Depth= 1.50"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.50"

	Area (ac)	CN	Description
*	0.820	78	
	0.820	78	100.00% Pervious Area

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

Subcatchment 1S: Predeveloped (On Site)



Hydrograph for Subcatchment 1S: Predeveloped (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
0.50	0.03	0.00	0.00	0.00
1.00	0.07	0.00	0.00	0.00
1.50	0.12	0.00	0.00	0.00
2.00	0.18	0.00	0.00	0.00
2.50	0.23	0.00	0.00	0.00
3.00	0.29	0.00	0.00	0.00
3.50	0.34	0.00	0.00	0.00
4.00	0.41	0.00	0.00	0.00
4.50	0.47	0.00	0.00	0.00
5.00	0.55	0.00	0.00	0.00
5.50	0.63	0.00	0.00	0.00
6.00	0.72	0.01	0.00	0.01
6.50	0.83	0.02	0.00	0.02
7.00	0.94	0.04	0.00	0.03
7.50	1.09	0.08	0.00	0.06
8.00	1.49	0.23	0.00	**0.22**
8.50	1.68	0.32	0.00	**0.15**
9.00	1.82	0.39	0.00	0.12
9.50	1.92	0.44	0.00	0.10
10.00	2.02	0.50	0.00	0.09
10.50	2.10	0.54	0.00	0.08
11.00	2.18	0.59	0.00	0.08
11.50	2.26	0.64	0.00	0.07
12.00	2.32	0.68	0.00	0.07
12.50	2.39	0.72	0.00	0.07
13.00	2.45	0.76	0.00	0.07
13.50	2.52	0.80	0.00	0.07
14.00	2.58	0.84	0.00	0.06
14.50	2.63	0.88	0.00	0.06
15.00	2.69	0.92	0.00	0.06
15.50	2.75	0.95	0.00	0.06
16.00	2.80	0.99	0.00	0.06
16.50	2.86	1.03	0.00	0.06
17.00	2.91	1.06	0.00	0.06
17.50	2.96	1.10	0.00	0.06
18.00	3.01	1.14	0.00	0.06
18.50	3.06	1.17	0.00	0.06
19.00	3.10	1.20	0.00	0.06
19.50	3.15	1.24	0.00	0.05
20.00	3.19	1.27	0.00	0.05
20.50	3.24	1.30	0.00	0.05
21.00	3.28	1.33	0.00	0.05
21.50	3.32	1.36	0.00	0.05
22.00	3.36	1.39	0.00	0.05
22.50	3.40	1.42	0.00	0.05
23.00	3.43	1.45	0.00	0.05
23.50	3.47	1.47	0.00	0.04
24.00	**3.50**	**1.50**	0.00	0.04
24.50	3.50	1.50	0.00	0.01
25.00	3.50	1.50	0.00	0.00
25.50	3.50	1.50	0.00	0.00
26.00	3.50	1.50	0.00	0.00
26.50	3.50	1.50	0.00	0.00
27.00	3.50	1.50	0.00	0.00
27.50	3.50	1.50	0.00	0.00
28.00	3.50	1.50	0.00	0.00
28.50	3.50	1.50	0.00	0.00
29.00	3.50	1.50	0.00	0.00
29.50	3.50	1.50	0.00	0.00
30.00	3.50	1.50	0.00	0.00
30.50	3.50	1.50	0.00	0.00
31.00	3.50	1.50	0.00	0.00
31.50	3.50	1.50	0.00	0.00
32.00	3.50	1.50	0.00	0.00
32.50	3.50	1.50	0.00	0.00
33.00	3.50	1.50	0.00	0.00
33.50	3.50	1.50	0.00	0.00
34.00	3.50	1.50	0.00	0.00
34.50	3.50	1.50	0.00	0.00
35.00	3.50	1.50	0.00	0.00
35.50	3.50	1.50	0.00	0.00
36.00	3.50	1.50	0.00	0.00
36.50	3.50	1.50	0.00	0.00
37.00	3.50	1.50	0.00	0.00
37.50	3.50	1.50	0.00	0.00
38.00	3.50	1.50	0.00	0.00
38.50	3.50	1.50	0.00	0.00
39.00	3.50	1.50	0.00	0.00
39.50	3.50	1.50	0.00	0.00
40.00	3.50	1.50	0.00	0.00
40.50	3.50	1.50	0.00	0.00
41.00	3.50	1.50	0.00	0.00
41.50	3.50	1.50	0.00	0.00
42.00	3.50	1.50	0.00	0.00
42.50	3.50	1.50	0.00	0.00
43.00	3.50	1.50	0.00	0.00
43.50	3.50	1.50	0.00	0.00
44.00	3.50	1.50	0.00	0.00
44.50	3.50	1.50	0.00	0.00
45.00	3.50	1.50	0.00	0.00
45.50	3.50	1.50	0.00	0.00
46.00	3.50	1.50	0.00	0.00
46.50	3.50	1.50	0.00	0.00
47.00	3.50	1.50	0.00	0.00
47.50	3.50	1.50	0.00	0.00
48.00	3.50	1.50	0.00	0.00
48.50	3.50	1.50	0.00	0.00
49.00	3.50	1.50	0.00	0.00
49.50	3.50	1.50	0.00	0.00
50.00	3.50	1.50	0.00	0.00

Summary for Subcatchment 2S: Developed (On Site)

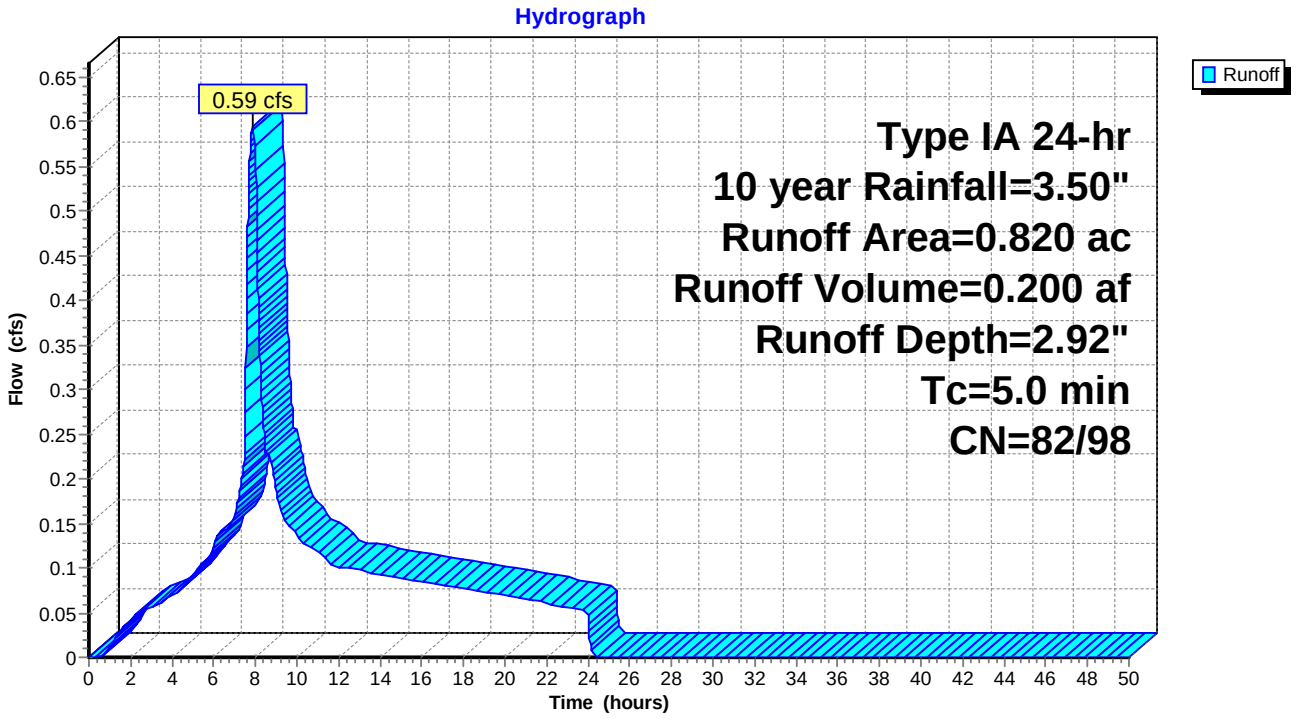
Runoff = 0.59 cfs @ 7.89 hrs, Volume= 0.200 af, Depth= 2.92"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 year Rainfall=3.50"

	Area (ac)	CN	Description
*	0.190	82	
*	0.630	98	
	0.820	94	Weighted Average
	0.190	82	23.17% Pervious Area
	0.630	98	76.83% Impervious Area

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

Subcatchment 2S: Developed (On Site)



Hydrograph for Subcatchment 2S: Developed (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00	0.00
1.00	0.07	0.00	0.00	0.01
1.50	0.12	0.00	0.02	0.03
2.00	0.18	0.00	0.05	0.04
2.50	0.23	0.00	0.09	0.05
3.00	0.29	0.00	0.13	0.06
3.50	0.34	0.00	0.18	0.06
4.00	0.41	0.00	0.23	0.07
4.50	0.47	0.00	0.29	0.08
5.00	0.55	0.00	0.36	0.09
5.50	0.63	0.02	0.44	0.11
6.00	0.72	0.03	0.52	0.12
6.50	0.83	0.06	0.63	0.15
7.00	0.94	0.09	0.73	0.16
7.50	1.09	0.15	0.87	**0.23**
8.00	1.49	0.34	1.27	**0.58**
8.50	1.68	0.45	1.46	0.23
9.00	1.82	0.53	1.60	0.19
9.50	1.92	0.60	1.70	0.15
10.00	2.02	0.66	1.79	0.14
10.50	2.10	0.72	1.88	0.12
11.00	2.18	0.77	1.96	0.12
11.50	2.26	0.82	2.03	0.11
12.00	2.32	0.87	2.10	0.10
12.50	2.39	0.92	2.16	0.10
13.00	2.45	0.96	2.22	0.10
13.50	2.52	1.01	2.29	0.09
14.00	2.58	1.05	2.35	0.09
14.50	2.63	1.10	2.40	0.09
15.00	2.69	1.14	2.46	0.09
15.50	2.75	1.18	2.52	0.09
16.00	2.80	1.23	2.57	0.08
16.50	2.86	1.27	2.63	0.08
17.00	2.91	1.31	2.68	0.08
17.50	2.96	1.35	2.73	0.08
18.00	3.01	1.39	2.78	0.08
18.50	3.06	1.42	2.83	0.07
19.00	3.10	1.46	2.87	0.07
19.50	3.15	1.50	2.92	0.07
20.00	3.19	1.53	2.96	0.07
20.50	3.24	1.57	3.00	0.07
21.00	3.28	1.60	3.05	0.06
21.50	3.32	1.63	3.09	0.06
22.00	3.36	1.67	3.12	0.06
22.50	3.40	1.70	3.16	0.06
23.00	3.43	1.73	3.20	0.06
23.50	3.47	1.75	3.23	0.05
24.00	**3.50**	**1.78**	**3.27**	0.05
24.50	3.50	1.78	3.27	0.00
25.00	3.50	1.78	3.27	0.00
25.50	3.50	1.78	3.27	0.00
26.00	3.50	1.78	3.27	0.00
26.50	3.50	1.78	3.27	0.00
27.00	3.50	1.78	3.27	0.00
27.50	3.50	1.78	3.27	0.00
28.00	3.50	1.78	3.27	0.00
28.50	3.50	1.78	3.27	0.00
29.00	3.50	1.78	3.27	0.00
29.50	3.50	1.78	3.27	0.00
30.00	3.50	1.78	3.27	0.00
30.50	3.50	1.78	3.27	0.00
31.00	3.50	1.78	3.27	0.00
31.50	3.50	1.78	3.27	0.00
32.00	3.50	1.78	3.27	0.00
32.50	3.50	1.78	3.27	0.00
33.00	3.50	1.78	3.27	0.00
33.50	3.50	1.78	3.27	0.00
34.00	3.50	1.78	3.27	0.00
34.50	3.50	1.78	3.27	0.00
35.00	3.50	1.78	3.27	0.00
35.50	3.50	1.78	3.27	0.00
36.00	3.50	1.78	3.27	0.00
36.50	3.50	1.78	3.27	0.00
37.00	3.50	1.78	3.27	0.00
37.50	3.50	1.78	3.27	0.00
38.00	3.50	1.78	3.27	0.00
38.50	3.50	1.78	3.27	0.00
39.00	3.50	1.78	3.27	0.00
39.50	3.50	1.78	3.27	0.00
40.00	3.50	1.78	3.27	0.00
40.50	3.50	1.78	3.27	0.00
41.00	3.50	1.78	3.27	0.00
41.50	3.50	1.78	3.27	0.00
42.00	3.50	1.78	3.27	0.00
42.50	3.50	1.78	3.27	0.00
43.00	3.50	1.78	3.27	0.00
43.50	3.50	1.78	3.27	0.00
44.00	3.50	1.78	3.27	0.00
44.50	3.50	1.78	3.27	0.00
45.00	3.50	1.78	3.27	0.00
45.50	3.50	1.78	3.27	0.00
46.00	3.50	1.78	3.27	0.00
46.50	3.50	1.78	3.27	0.00
47.00	3.50	1.78	3.27	0.00
47.50	3.50	1.78	3.27	0.00
48.00	3.50	1.78	3.27	0.00
48.50	3.50	1.78	3.27	0.00
49.00	3.50	1.78	3.27	0.00
49.50	3.50	1.78	3.27	0.00
50.00	3.50	1.78	3.27	0.00

Summary for Pond 3P: Detention Chambers

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.820 ac, 76.83% Impervious, Inflow Depth = 2.92" for 10 year event
Inflow = 0.59 cfs @ 7.89 hrs, Volume= 0.200 af
Outflow = 0.22 cfs @ 8.75 hrs, Volume= 0.200 af, Atten= 63%, Lag= 51.9 min
Primary = 0.22 cfs @ 8.75 hrs, Volume= 0.200 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 198.56' @ 8.75 hrs Surf.Area= 1,685 sf Storage= 2,199 cf

Plug-Flow detention time= 260.8 min calculated for 0.200 af (100% of inflow)
Center-of-Mass det. time= 260.9 min (942.8 - 681.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.58'	1,094 cf	**32.75'W x 51.46'L x 3.50'H Field A** 5,898 cf Overall - 2,251 cf Embedded = 3,647 cf x 30.0% Voids
#2A	197.08'	2,251 cf	**ADS_StormTech SC-740 +Cap** x 49 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 49 Chambers in 7 Rows
		3,345 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	195.96'	**12.0" Round Culvert** L= 31.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 195.96' / 195.65' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	193.96'	**1.2" Vert. Orifice/Grate** C= 0.600
#3	Device 1	198.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	198.86'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.22 cfs @ 8.75 hrs HW=198.56' (Free Discharge)
└**1=Culvert** (Passes 0.22 cfs of 6.05 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 7.77 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.16 cfs @ 3.18 fps)
  └**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: Detention Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

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

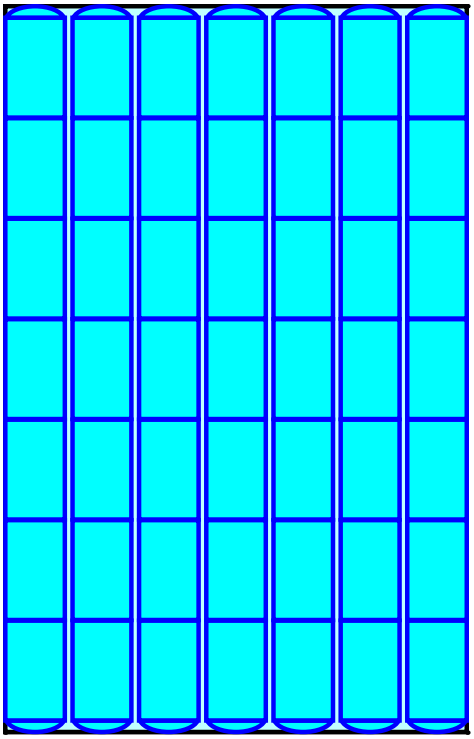
7 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 51.46' Row Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 = 32.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

49 Chambers x 45.9 cf = 2,251.1 cf Chamber Storage

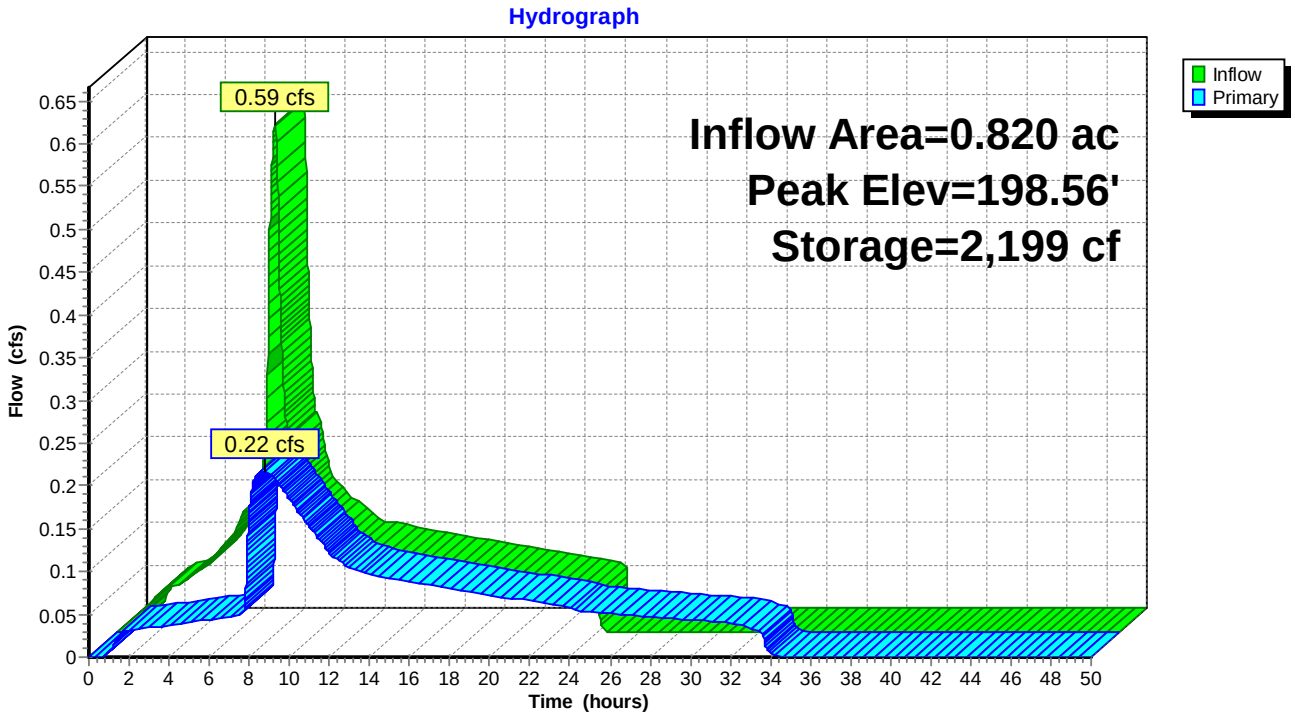
5,898.2 cf Field - 2,251.1 cf Chambers = 3,647.2 cf Stone x 30.0% Voids = 1,094.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,345.2 cf = 0.077 af
Overall Storage Efficiency = 56.7%
Overall System Size = 51.46' x 32.75' x 3.50'

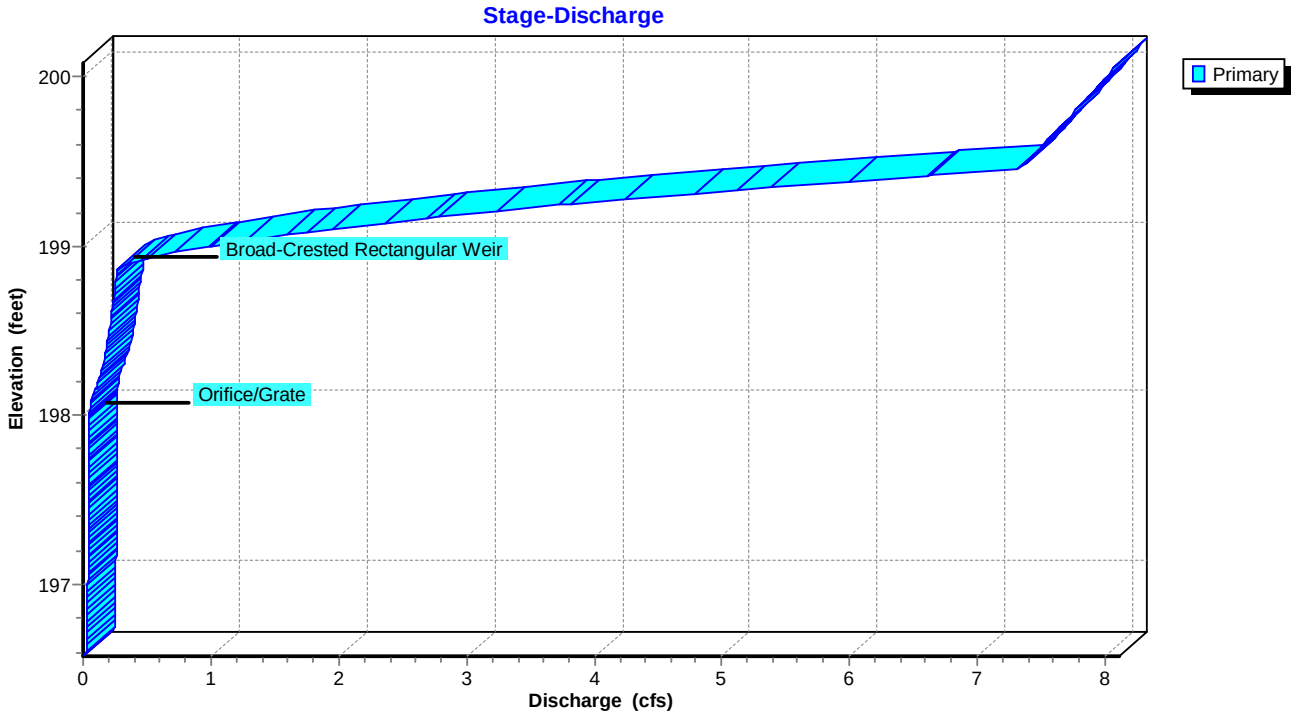
49 Chambers
218.5 cy Field
135.1 cy Stone



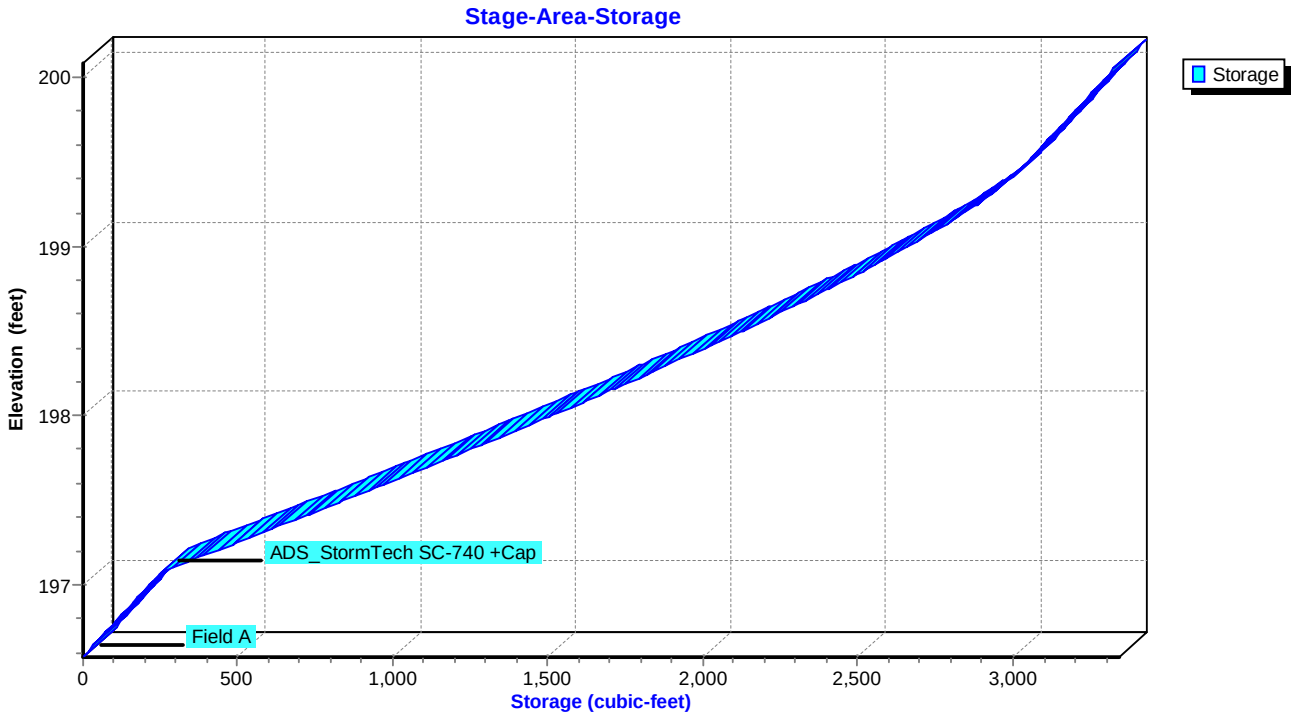
Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Hydrograph for Pond 3P: Detention Chambers

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	196.58	0.00
1.00	0.01	3	196.59	0.01
2.00	0.04	26	196.63	0.03
3.00	0.06	91	196.76	0.03
4.00	0.07	186	196.95	0.04
5.00	0.09	328	197.13	0.04
6.00	0.12	558	197.30	0.04
7.00	**0.16**	900	197.54	0.05
8.00	**0.58**	**1,933**	**198.34**	**0.17**
9.00	0.19	**2,187**	**198.55**	**0.22**
10.00	0.14	2,019	198.41	0.19
11.00	0.12	1,870	198.29	0.15
12.00	0.10	1,767	198.20	0.12
13.00	0.10	1,723	198.17	0.10
14.00	0.09	1,702	198.15	0.10
15.00	0.09	1,688	198.14	0.09
16.00	0.08	1,677	198.13	0.09
17.00	0.08	1,666	198.12	0.08
18.00	0.08	1,654	198.11	0.08
19.00	0.07	1,641	198.10	0.08
20.00	0.07	1,628	198.09	0.07
21.00	0.06	1,615	198.08	0.07
22.00	0.06	1,599	198.07	0.07
23.00	0.06	1,582	198.06	0.06
24.00	0.05	1,562	198.04	0.06
25.00	0.00	1,383	197.90	0.05
26.00	0.00	1,197	197.76	0.05
27.00	0.00	1,018	197.63	0.05
28.00	0.00	845	197.50	0.05
29.00	0.00	679	197.38	0.05
30.00	0.00	520	197.27	0.04
31.00	0.00	368	197.16	0.04
32.00	0.00	222	197.02	0.04
33.00	0.00	91	196.76	0.03
34.00	0.00	2	196.58	0.00
35.00	0.00	0	196.58	0.00
36.00	0.00	0	196.58	0.00
37.00	0.00	0	196.58	0.00
38.00	0.00	0	196.58	0.00
39.00	0.00	0	196.58	0.00
40.00	0.00	0	196.58	0.00
41.00	0.00	0	196.58	0.00
42.00	0.00	0	196.58	0.00
43.00	0.00	0	196.58	0.00
44.00	0.00	0	196.58	0.00
45.00	0.00	0	196.58	0.00
46.00	0.00	0	196.58	0.00
47.00	0.00	0	196.58	0.00
48.00	0.00	0	196.58	0.00
49.00	0.00	0	196.58	0.00
50.00	0.00	0	196.58	0.00

Stage-Discharge for Pond 3P: Detention Chambers

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
196.58	0.00	197.66	0.05	198.74	0.25	199.82	7.79
196.60	0.03	197.68	0.05	198.76	0.25	199.84	7.82
196.62	0.03	197.70	0.05	198.78	0.25	199.86	7.84
196.64	0.03	197.72	0.05	198.80	0.26	199.88	7.87
196.66	0.03	197.74	0.05	198.82	0.26	199.90	7.89
196.68	0.03	197.76	0.05	198.84	0.26	199.92	7.92
196.70	0.03	197.78	0.05	198.86	0.27	199.94	7.94
196.72	0.03	197.80	0.05	198.88	0.31	199.96	7.96
196.74	0.03	197.82	0.05	198.90	0.38	199.98	7.99
196.76	0.03	197.84	0.05	198.92	0.48	200.00	8.01
196.78	0.03	197.86	0.05	198.94	0.60	200.02	8.04
196.80	0.03	197.88	0.05	198.96	0.72	200.04	8.06
196.82	0.04	197.90	0.05	198.98	0.87	200.06	8.08
196.84	0.04	197.92	0.05	199.00	1.02	200.08	**8.11**
196.86	0.04	197.94	0.05	199.02	1.19		
196.88	0.04	197.96	0.05	199.04	1.36		
196.90	0.04	197.98	0.05	199.06	1.55		
196.92	0.04	198.00	0.05	199.08	1.75		
196.94	0.04	198.02	0.06	199.10	1.96		
196.96	0.04	198.04	0.06	199.12	2.18		
196.98	0.04	198.06	0.06	199.14	2.42		
197.00	0.04	198.08	0.07	199.16	2.66		
197.02	0.04	198.10	0.08	199.18	2.91		
197.04	0.04	198.12	0.08	199.20	3.17		
197.06	0.04	198.14	0.09	199.22	3.44		
197.08	0.04	198.16	0.10	199.24	3.72		
197.10	0.04	198.18	0.11	199.26	4.01		
197.12	0.04	198.20	0.12	199.28	4.32		
197.14	0.04	198.22	0.13	199.30	4.63		
197.16	0.04	198.24	0.14	199.32	4.96		
197.18	0.04	198.26	0.14	199.34	5.29		
197.20	0.04	198.28	0.15	199.36	5.64		
197.22	0.04	198.30	0.16	199.38	5.99		
197.24	0.04	198.32	0.16	199.40	6.35		
197.26	0.04	198.34	0.17	199.42	6.73		
197.28	0.04	198.36	0.17	199.44	7.11		
197.30	0.04	198.38	0.18	199.46	7.34		
197.32	0.04	198.40	0.18	199.48	7.36		
197.34	0.04	198.42	0.19	199.50	7.39		
197.36	0.04	198.44	0.19	199.52	7.42		
197.38	0.05	198.46	0.20	199.54	7.44		
197.40	0.05	198.48	0.20	199.56	7.47		
197.42	0.05	198.50	0.21	199.58	7.49		
197.44	0.05	198.52	0.21	199.60	7.52		
197.46	0.05	198.54	0.21	199.62	7.54		
197.48	0.05	198.56	0.22	199.64	7.57		
197.50	0.05	198.58	0.22	199.66	7.59		
197.52	0.05	198.60	0.22	199.68	7.62		
197.54	0.05	198.62	0.23	199.70	7.64		
197.56	0.05	198.64	0.23	199.72	7.67		
197.58	0.05	198.66	0.24	199.74	7.69		
197.60	0.05	198.68	0.24	199.76	7.72		
197.62	0.05	198.70	0.24	199.78	7.74		
197.64	0.05	198.72	0.25	199.80	7.77		

Stage-Area-Storage for Pond 3P: Detention Chambers

Elevation (feet)	Storage (cubic-feet)
196.58	0
196.63	25
196.68	51
196.73	76
196.78	101
196.83	126
196.88	152
196.93	177
196.98	202
197.03	228
197.08	253
197.13	323
197.18	394
197.23	465
197.28	535
197.33	605
197.38	675
197.43	744
197.48	813
197.53	882
197.58	950
197.63	1,019
197.68	1,086
197.73	1,154
197.78	1,220
197.83	1,287
197.88	1,353
197.93	1,418
197.98	1,484
198.03	1,548
198.08	1,612
198.13	1,676
198.18	1,739
198.23	1,801
198.28	1,863
198.33	1,924
198.38	1,985
198.43	2,044
198.48	2,104
198.53	2,162
198.58	2,220
198.63	2,276
198.68	2,332
198.73	2,387
198.78	2,441
198.83	2,494
198.88	2,546
198.93	2,596
198.98	2,646
199.03	2,694
199.08	2,741
199.13	2,786
199.18	2,830
199.23	2,872
199.28	2,911
199.33	2,947
199.38	2,980
199.43	3,010
199.48	3,039
199.53	3,066
199.58	3,092
199.63	3,118
199.68	3,143
199.73	3,168
199.78	3,194
199.83	3,219
199.88	3,244
199.93	3,269
199.98	3,295
200.03	3,320
200.08	**3,345**

Time span=0.00-50.00 hrs, dt=0.01 hrs, 5001 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Predeveloped (On Site) Runoff Area=0.820 ac 0.00% Impervious Runoff Depth=1.89"
Tc=16.4 min CN=78/0 Runoff=0.30 cfs 0.129 af

Subcatchment 2S: Developed (On Site) Runoff Area=0.820 ac 76.83% Impervious Runoff Depth=3.40"
Tc=5.0 min CN=82/98 Runoff=0.69 cfs 0.233 af

Pond 3P: Detention Chambers Peak Elev=198.87' Storage=2,538 cf Inflow=0.69 cfs 0.233 af
Outflow=0.30 cfs 0.233 af

Total Runoff Area = 1.640 ac Runoff Volume = 0.361 af Average Runoff Depth = 2.65"
61.59% Pervious = 1.010 ac 38.41% Impervious = 0.630 ac

Summary for Subcatchment 1S: Predeveloped (On Site)

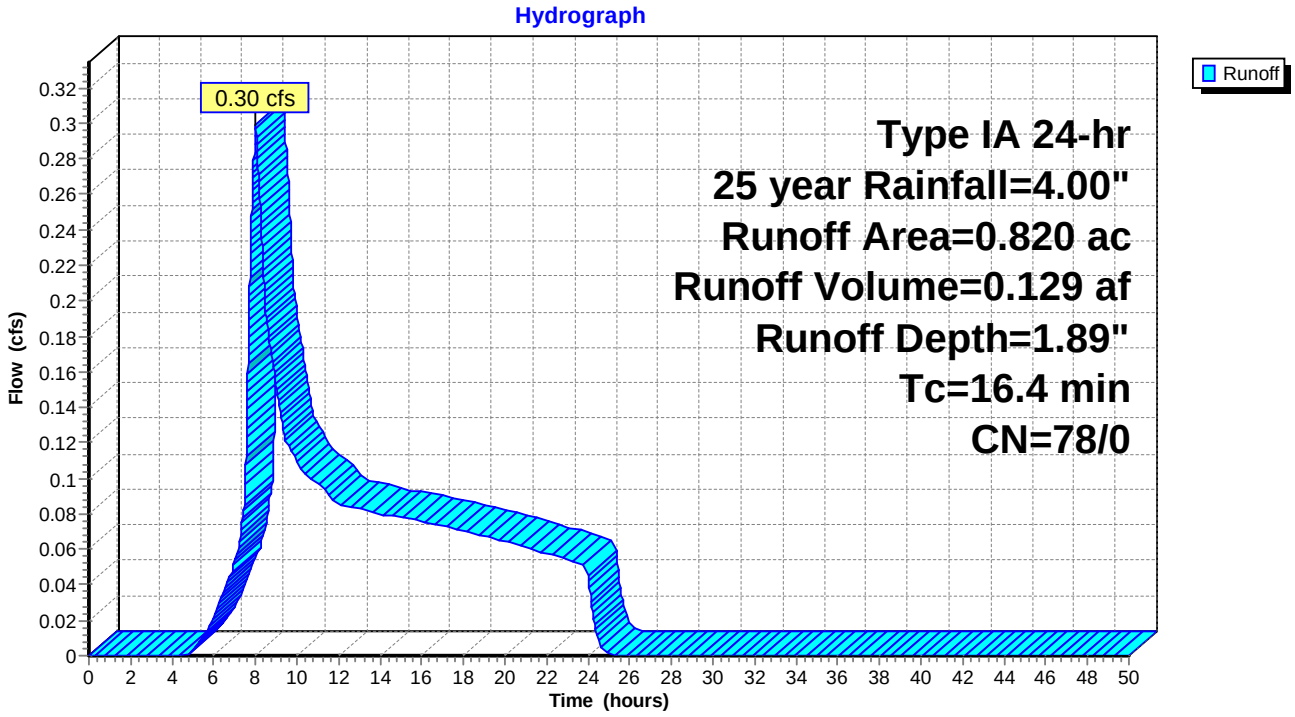
Runoff = 0.30 cfs @ 8.01 hrs, Volume= 0.129 af, Depth= 1.89"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=4.00"

	Area (ac)	CN	Description
*	0.820	78	
	0.820	78	100.00% Pervious Area

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

Subcatchment 1S: Predeveloped (On Site)



Hydrograph for Subcatchment 1S: Predeveloped (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	**0.00**	0.00
0.50	0.04	0.00	0.00	0.00
1.00	0.08	0.00	0.00	0.00
1.50	0.14	0.00	0.00	0.00
2.00	0.20	0.00	0.00	0.00
2.50	0.26	0.00	0.00	0.00
3.00	0.33	0.00	0.00	0.00
3.50	0.39	0.00	0.00	0.00
4.00	0.46	0.00	0.00	0.00
4.50	0.54	0.00	0.00	0.00
5.00	0.62	0.00	0.00	0.00
5.50	0.72	0.01	0.00	0.01
6.00	0.82	0.02	0.00	0.02
6.50	0.95	0.05	0.00	0.04
7.00	1.07	0.08	0.00	0.05
7.50	1.24	0.13	0.00	0.09
8.00	1.70	0.33	0.00	**0.30**
8.50	1.92	0.44	0.00	**0.19**
9.00	2.08	0.53	0.00	0.15
9.50	2.20	0.60	0.00	0.12
10.00	2.31	0.67	0.00	0.11
10.50	2.40	0.73	0.00	0.10
11.00	2.50	0.79	0.00	0.10
11.50	2.58	0.84	0.00	0.09
12.00	2.66	0.89	0.00	0.08
12.50	2.73	0.94	0.00	0.09
13.00	2.80	0.99	0.00	0.08
13.50	2.88	1.04	0.00	0.08
14.00	2.94	1.09	0.00	0.08
14.50	3.01	1.14	0.00	0.08
15.00	3.08	1.18	0.00	0.08
15.50	3.14	1.23	0.00	0.08
16.00	3.20	1.28	0.00	0.08
16.50	3.26	1.32	0.00	0.07
17.00	3.32	1.37	0.00	0.07
17.50	3.38	1.41	0.00	0.07
18.00	3.44	1.45	0.00	0.07
18.50	3.49	1.49	0.00	0.07
19.00	3.55	1.53	0.00	0.07
19.50	3.60	1.57	0.00	0.07
20.00	3.65	1.61	0.00	0.06
20.50	3.70	1.65	0.00	0.06
21.00	3.75	1.69	0.00	0.06
21.50	3.79	1.72	0.00	0.06
22.00	3.84	1.76	0.00	0.06
22.50	3.88	1.79	0.00	0.06
23.00	3.92	1.82	0.00	0.05
23.50	3.96	1.86	0.00	0.05
24.00	**4.00**	**1.89**	0.00	0.05
24.50	4.00	1.89	0.00	0.01
25.00	4.00	1.89	0.00	0.00
25.50	4.00	1.89	0.00	0.00
26.00	4.00	1.89	0.00	0.00
26.50	4.00	1.89	0.00	0.00
27.00	4.00	1.89	0.00	0.00
27.50	4.00	1.89	0.00	0.00
28.00	4.00	1.89	0.00	0.00
28.50	4.00	1.89	0.00	0.00
29.00	4.00	1.89	0.00	0.00
29.50	4.00	1.89	0.00	0.00
30.00	4.00	1.89	0.00	0.00
30.50	4.00	1.89	0.00	0.00
31.00	4.00	1.89	0.00	0.00
31.50	4.00	1.89	0.00	0.00
32.00	4.00	1.89	0.00	0.00
32.50	4.00	1.89	0.00	0.00
33.00	4.00	1.89	0.00	0.00
33.50	4.00	1.89	0.00	0.00
34.00	4.00	1.89	0.00	0.00
34.50	4.00	1.89	0.00	0.00
35.00	4.00	1.89	0.00	0.00
35.50	4.00	1.89	0.00	0.00
36.00	4.00	1.89	0.00	0.00
36.50	4.00	1.89	0.00	0.00
37.00	4.00	1.89	0.00	0.00
37.50	4.00	1.89	0.00	0.00
38.00	4.00	1.89	0.00	0.00
38.50	4.00	1.89	0.00	0.00
39.00	4.00	1.89	0.00	0.00
39.50	4.00	1.89	0.00	0.00
40.00	4.00	1.89	0.00	0.00
40.50	4.00	1.89	0.00	0.00
41.00	4.00	1.89	0.00	0.00
41.50	4.00	1.89	0.00	0.00
42.00	4.00	1.89	0.00	0.00
42.50	4.00	1.89	0.00	0.00
43.00	4.00	1.89	0.00	0.00
43.50	4.00	1.89	0.00	0.00
44.00	4.00	1.89	0.00	0.00
44.50	4.00	1.89	0.00	0.00
45.00	4.00	1.89	0.00	0.00
45.50	4.00	1.89	0.00	0.00
46.00	4.00	1.89	0.00	0.00
46.50	4.00	1.89	0.00	0.00
47.00	4.00	1.89	0.00	0.00
47.50	4.00	1.89	0.00	0.00
48.00	4.00	1.89	0.00	0.00
48.50	4.00	1.89	0.00	0.00
49.00	4.00	1.89	0.00	0.00
49.50	4.00	1.89	0.00	0.00
50.00	4.00	1.89	0.00	0.00

Summary for Subcatchment 2S: Developed (On Site)

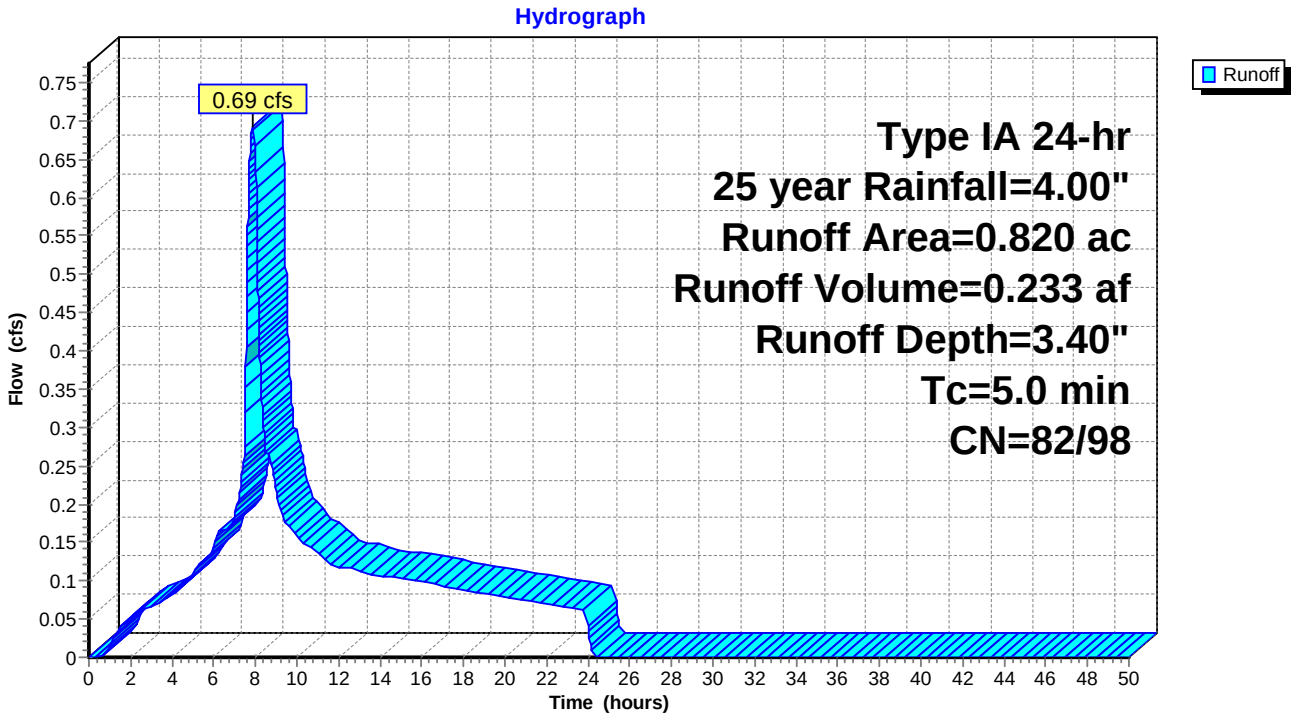
Runoff = 0.69 cfs @ 7.89 hrs, Volume= 0.233 af, Depth= 3.40"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 year Rainfall=4.00"

	Area (ac)	CN	Description
*	0.190	82	
*	0.630	98	
	0.820	94	Weighted Average
	0.190	82	23.17% Pervious Area
	0.630	98	76.83% Impervious Area

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

Subcatchment 2S: Developed (On Site)



Hydrograph for Subcatchment 2S: Developed (On Site)

Time (hours)	Precip. (inches)	Perv.Excess (inches)	Imp.Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00	0.00
1.00	0.08	0.00	0.01	0.01
1.50	0.14	0.00	0.03	0.04
2.00	0.20	0.00	0.07	0.05
2.50	0.26	0.00	0.12	0.06
3.00	0.33	0.00	0.17	0.07
3.50	0.39	0.00	0.22	0.07
4.00	0.46	0.00	0.29	0.08
4.50	0.54	0.00	0.35	0.09
5.00	0.62	0.01	0.43	0.11
5.50	0.72	0.03	0.52	0.13
6.00	0.82	0.06	0.62	0.14
6.50	0.95	0.10	0.74	0.17
7.00	1.07	0.14	0.86	0.18
7.50	1.24	0.21	1.02	**0.27**
8.00	1.70	0.46	1.48	**0.67**
8.50	1.92	0.60	1.70	0.26
9.00	2.08	0.70	1.85	0.22
9.50	2.20	0.78	1.97	0.17
10.00	2.31	0.86	2.08	0.16
10.50	2.40	0.93	2.18	0.14
11.00	2.50	1.00	2.27	0.14
11.50	2.58	1.06	2.35	0.13
12.00	2.66	1.11	2.43	0.12
12.50	2.73	1.17	2.50	0.12
13.00	2.80	1.23	2.57	0.11
13.50	2.88	1.28	2.64	0.11
14.00	2.94	1.34	2.71	0.11
14.50	3.01	1.39	2.78	0.10
15.00	3.08	1.44	2.84	0.10
15.50	3.14	1.49	2.91	0.10
16.00	3.20	1.54	2.97	0.10
16.50	3.26	1.59	3.03	0.10
17.00	3.32	1.64	3.09	0.09
17.50	3.38	1.69	3.15	0.09
18.00	3.44	1.73	3.21	0.09
18.50	3.49	1.78	3.26	0.09
19.00	3.55	1.82	3.31	0.08
19.50	3.60	1.87	3.37	0.08
20.00	3.65	1.91	3.42	0.08
20.50	3.70	1.95	3.47	0.08
21.00	3.75	1.99	3.51	0.07
21.50	3.79	2.03	3.56	0.07
22.00	3.84	2.06	3.60	0.07
22.50	3.88	2.10	3.65	0.07
23.00	3.92	2.14	3.69	0.07
23.50	3.96	2.17	3.73	0.06
24.00	**4.00**	**2.20**	**3.77**	0.06
24.50	4.00	2.20	3.77	0.00
25.00	4.00	2.20	3.77	0.00
25.50	4.00	2.20	3.77	0.00
26.00	4.00	2.20	3.77	0.00
26.50	4.00	2.20	3.77	0.00
27.00	4.00	2.20	3.77	0.00
27.50	4.00	2.20	3.77	0.00
28.00	4.00	2.20	3.77	0.00
28.50	4.00	2.20	3.77	0.00
29.00	4.00	2.20	3.77	0.00
29.50	4.00	2.20	3.77	0.00
30.00	4.00	2.20	3.77	0.00
30.50	4.00	2.20	3.77	0.00
31.00	4.00	2.20	3.77	0.00
31.50	4.00	2.20	3.77	0.00
32.00	4.00	2.20	3.77	0.00
32.50	4.00	2.20	3.77	0.00
33.00	4.00	2.20	3.77	0.00
33.50	4.00	2.20	3.77	0.00
34.00	4.00	2.20	3.77	0.00
34.50	4.00	2.20	3.77	0.00
35.00	4.00	2.20	3.77	0.00
35.50	4.00	2.20	3.77	0.00
36.00	4.00	2.20	3.77	0.00
36.50	4.00	2.20	3.77	0.00
37.00	4.00	2.20	3.77	0.00
37.50	4.00	2.20	3.77	0.00
38.00	4.00	2.20	3.77	0.00
38.50	4.00	2.20	3.77	0.00
39.00	4.00	2.20	3.77	0.00
39.50	4.00	2.20	3.77	0.00
40.00	4.00	2.20	3.77	0.00
40.50	4.00	2.20	3.77	0.00
41.00	4.00	2.20	3.77	0.00
41.50	4.00	2.20	3.77	0.00
42.00	4.00	2.20	3.77	0.00
42.50	4.00	2.20	3.77	0.00
43.00	4.00	2.20	3.77	0.00
43.50	4.00	2.20	3.77	0.00
44.00	4.00	2.20	3.77	0.00
44.50	4.00	2.20	3.77	0.00
45.00	4.00	2.20	3.77	0.00
45.50	4.00	2.20	3.77	0.00
46.00	4.00	2.20	3.77	0.00
46.50	4.00	2.20	3.77	0.00
47.00	4.00	2.20	3.77	0.00
47.50	4.00	2.20	3.77	0.00
48.00	4.00	2.20	3.77	0.00
48.50	4.00	2.20	3.77	0.00
49.00	4.00	2.20	3.77	0.00
49.50	4.00	2.20	3.77	0.00
50.00	4.00	2.20	3.77	0.00

Summary for Pond 3P: Detention Chambers

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 0.820 ac, 76.83% Impervious, Inflow Depth = 3.40" for 25 year event
Inflow = 0.69 cfs @ 7.89 hrs, Volume= 0.233 af
Outflow = 0.30 cfs @ 8.40 hrs, Volume= 0.233 af, Atten= 57%, Lag= 30.6 min
Primary = 0.30 cfs @ 8.40 hrs, Volume= 0.233 af

Routing by Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 198.87' @ 8.40 hrs Surf.Area= 1,685 sf Storage= 2,538 cf

Plug-Flow detention time= 239.9 min calculated for 0.233 af (100% of inflow)
Center-of-Mass det. time= 239.9 min (918.2 - 678.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	196.58'	1,094 cf	**32.75'W x 51.46'L x 3.50'H Field A** 5,898 cf Overall - 2,251 cf Embedded = 3,647 cf x 30.0% Voids
#2A	197.08'	2,251 cf	**ADS_StormTech SC-740 +Cap** x 49 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 49 Chambers in 7 Rows
		3,345 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	195.96'	**12.0" Round Culvert** L= 31.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 195.96' / 195.65' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	193.96'	**1.2" Vert. Orifice/Grate** C= 0.600
#3	Device 1	198.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	198.86'	**5.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.29 cfs @ 8.40 hrs HW=198.87' (Free Discharge)
└**1=Culvert** (Passes 0.29 cfs of 6.53 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.06 cfs @ 8.22 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.20 cfs @ 4.16 fps)
  └**4=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.31 fps)

Pond 3P: Detention Chambers - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

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

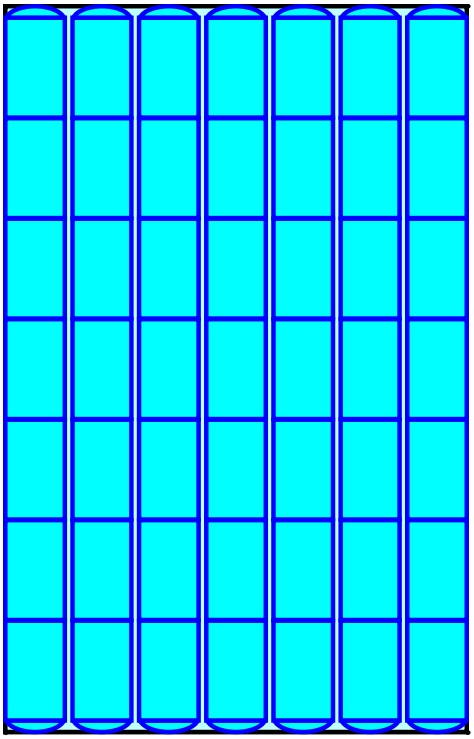
7 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 51.46' Row Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 = 32.75' Base Width
6.0" Base + 30.0" Chamber Height + 6.0" Cover = 3.50' Field Height

49 Chambers x 45.9 cf = 2,251.1 cf Chamber Storage

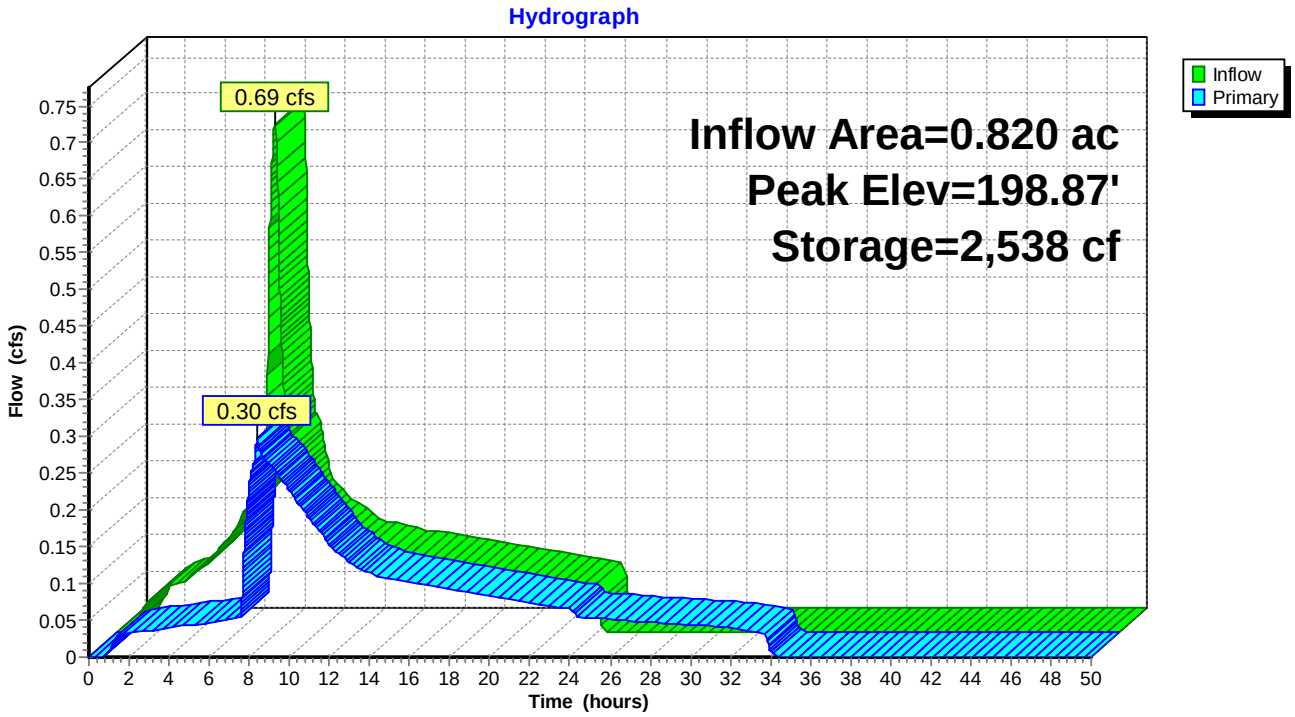
5,898.2 cf Field - 2,251.1 cf Chambers = 3,647.2 cf Stone x 30.0% Voids = 1,094.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,345.2 cf = 0.077 af
Overall Storage Efficiency = 56.7%
Overall System Size = 51.46' x 32.75' x 3.50'

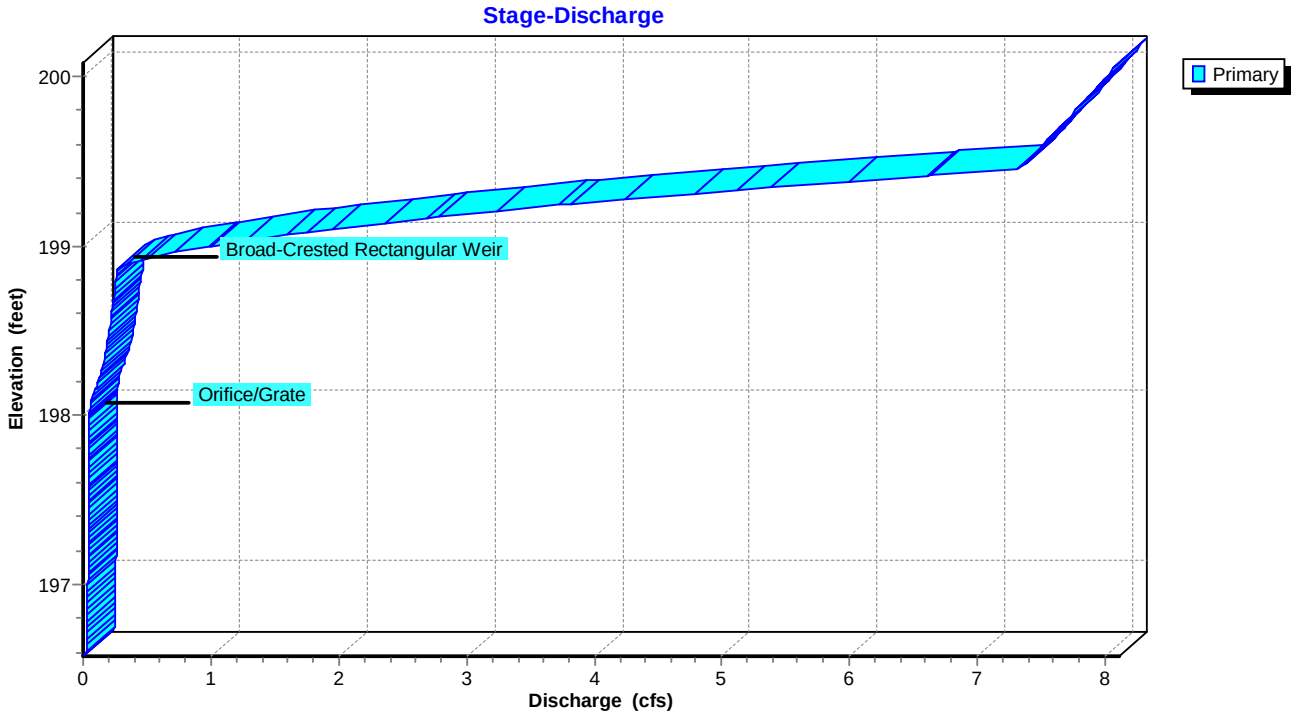
49 Chambers
218.5 cy Field
135.1 cy Stone



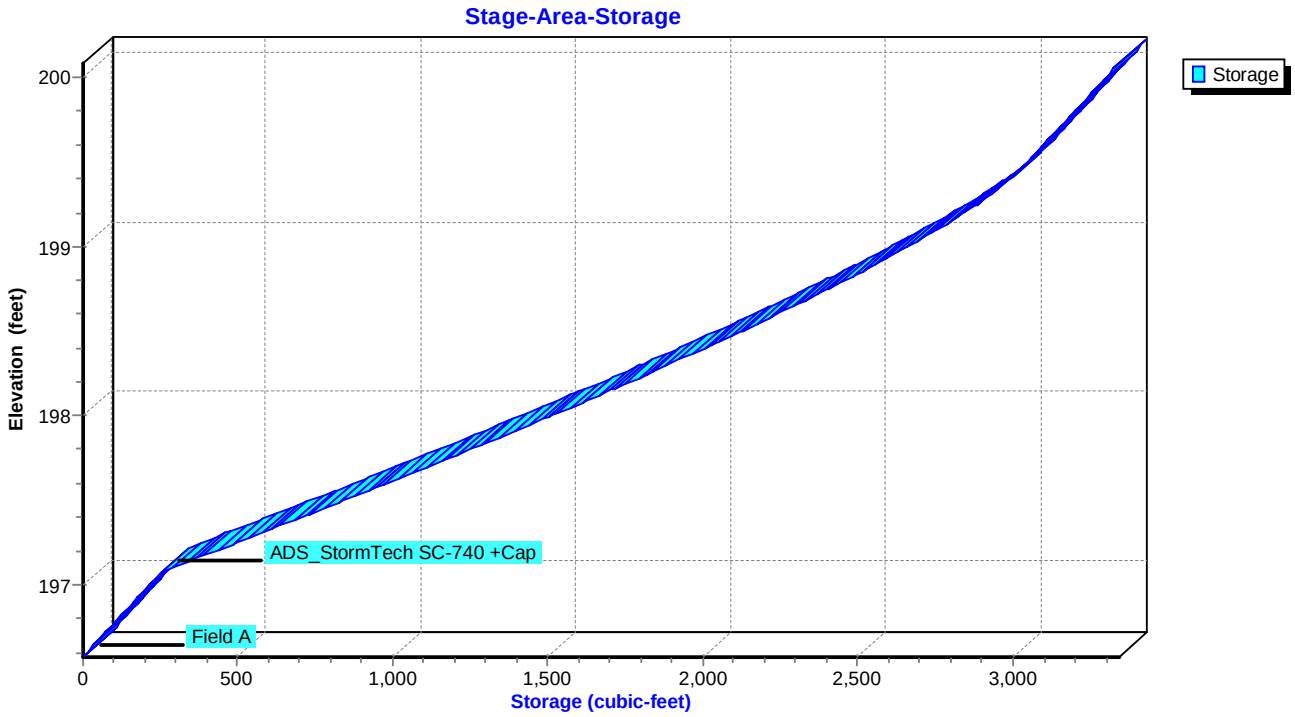
Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Pond 3P: Detention Chambers



Hydrograph for Pond 3P: Detention Chambers

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	196.58	0.00
1.00	0.01	5	196.59	0.01
2.00	0.05	45	196.67	0.03
3.00	0.07	143	196.86	0.04
4.00	0.08	270	197.09	0.04
5.00	0.11	458	197.23	0.04
6.00	0.14	750	197.43	0.05
7.00	**0.18**	1,170	197.74	0.05
8.00	**0.67**	**2,298**	**198.65**	**0.23**
9.00	0.22	**2,497**	**198.83**	**0.26**
10.00	0.16	2,257	198.61	0.23
11.00	0.14	2,039	198.43	0.19
12.00	0.12	1,875	198.29	0.15
13.00	0.11	1,786	198.22	0.13
14.00	0.11	1,746	198.19	0.11
15.00	0.10	1,727	198.17	0.11
16.00	0.10	1,714	198.16	0.10
17.00	0.09	1,702	198.15	0.10
18.00	0.09	1,689	198.14	0.09
19.00	0.08	1,676	198.13	0.09
20.00	0.08	1,663	198.12	0.08
21.00	0.07	1,649	198.11	0.08
22.00	0.07	1,634	198.10	0.07
23.00	0.07	1,618	198.08	0.07
24.00	0.06	1,601	198.07	0.07
25.00	0.00	1,417	197.93	0.05
26.00	0.00	1,229	197.79	0.05
27.00	0.00	1,049	197.65	0.05
28.00	0.00	875	197.53	0.05
29.00	0.00	708	197.40	0.05
30.00	0.00	548	197.29	0.04
31.00	0.00	394	197.18	0.04
32.00	0.00	247	197.07	0.04
33.00	0.00	113	196.80	0.03
34.00	0.00	5	196.59	0.01
35.00	0.00	0	196.58	0.00
36.00	0.00	0	196.58	0.00
37.00	0.00	0	196.58	0.00
38.00	0.00	0	196.58	0.00
39.00	0.00	0	196.58	0.00
40.00	0.00	0	196.58	0.00
41.00	0.00	0	196.58	0.00
42.00	0.00	0	196.58	0.00
43.00	0.00	0	196.58	0.00
44.00	0.00	0	196.58	0.00
45.00	0.00	0	196.58	0.00
46.00	0.00	0	196.58	0.00
47.00	0.00	0	196.58	0.00
48.00	0.00	0	196.58	0.00
49.00	0.00	0	196.58	0.00
50.00	0.00	0	196.58	0.00

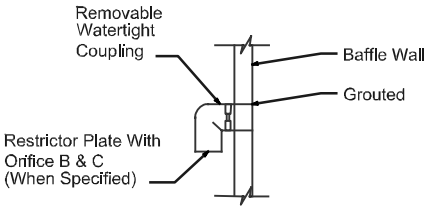
Stage-Discharge for Pond 3P: Detention Chambers

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
196.58	0.00	197.66	0.05	198.74	0.25	199.82	7.79
196.60	0.03	197.68	0.05	198.76	0.25	199.84	7.82
196.62	0.03	197.70	0.05	198.78	0.25	199.86	7.84
196.64	0.03	197.72	0.05	198.80	0.26	199.88	7.87
196.66	0.03	197.74	0.05	198.82	0.26	199.90	7.89
196.68	0.03	197.76	0.05	198.84	0.26	199.92	7.92
196.70	0.03	197.78	0.05	198.86	0.27	199.94	7.94
196.72	0.03	197.80	0.05	198.88	0.31	199.96	7.96
196.74	0.03	197.82	0.05	198.90	0.38	199.98	7.99
196.76	0.03	197.84	0.05	198.92	0.48	200.00	8.01
196.78	0.03	197.86	0.05	198.94	0.60	200.02	8.04
196.80	0.03	197.88	0.05	198.96	0.72	200.04	8.06
196.82	0.04	197.90	0.05	198.98	0.87	200.06	8.08
196.84	0.04	197.92	0.05	199.00	1.02	200.08	**8.11**
196.86	0.04	197.94	0.05	199.02	1.19		
196.88	0.04	197.96	0.05	199.04	1.36		
196.90	0.04	197.98	0.05	199.06	1.55		
196.92	0.04	198.00	0.05	199.08	1.75		
196.94	0.04	198.02	0.06	199.10	1.96		
196.96	0.04	198.04	0.06	199.12	2.18		
196.98	0.04	198.06	0.06	199.14	2.42		
197.00	0.04	198.08	0.07	199.16	2.66		
197.02	0.04	198.10	0.08	199.18	2.91		
197.04	0.04	198.12	0.08	199.20	3.17		
197.06	0.04	198.14	0.09	199.22	3.44		
197.08	0.04	198.16	0.10	199.24	3.72		
197.10	0.04	198.18	0.11	199.26	4.01		
197.12	0.04	198.20	0.12	199.28	4.32		
197.14	0.04	198.22	0.13	199.30	4.63		
197.16	0.04	198.24	0.14	199.32	4.96		
197.18	0.04	198.26	0.14	199.34	5.29		
197.20	0.04	198.28	0.15	199.36	5.64		
197.22	0.04	198.30	0.16	199.38	5.99		
197.24	0.04	198.32	0.16	199.40	6.35		
197.26	0.04	198.34	0.17	199.42	6.73		
197.28	0.04	198.36	0.17	199.44	7.11		
197.30	0.04	198.38	0.18	199.46	7.34		
197.32	0.04	198.40	0.18	199.48	7.36		
197.34	0.04	198.42	0.19	199.50	7.39		
197.36	0.04	198.44	0.19	199.52	7.42		
197.38	0.05	198.46	0.20	199.54	7.44		
197.40	0.05	198.48	0.20	199.56	7.47		
197.42	0.05	198.50	0.21	199.58	7.49		
197.44	0.05	198.52	0.21	199.60	7.52		
197.46	0.05	198.54	0.21	199.62	7.54		
197.48	0.05	198.56	0.22	199.64	7.57		
197.50	0.05	198.58	0.22	199.66	7.59		
197.52	0.05	198.60	0.22	199.68	7.62		
197.54	0.05	198.62	0.23	199.70	7.64		
197.56	0.05	198.64	0.23	199.72	7.67		
197.58	0.05	198.66	0.24	199.74	7.69		
197.60	0.05	198.68	0.24	199.76	7.72		
197.62	0.05	198.70	0.24	199.78	7.74		
197.64	0.05	198.72	0.25	199.80	7.77		

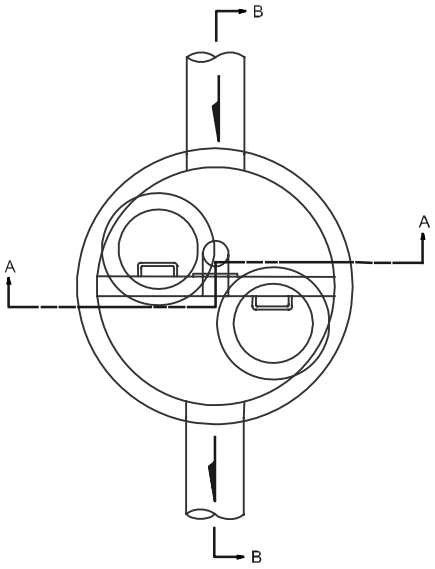
Stage-Area-Storage for Pond 3P: Detention Chambers

Elevation (feet)	Storage (cubic-feet)
196.58	0
196.63	25
196.68	51
196.73	76
196.78	101
196.83	126
196.88	152
196.93	177
196.98	202
197.03	228
197.08	253
197.13	323
197.18	394
197.23	465
197.28	535
197.33	605
197.38	675
197.43	744
197.48	813
197.53	882
197.58	950
197.63	1,019
197.68	1,086
197.73	1,154
197.78	1,220
197.83	1,287
197.88	1,353
197.93	1,418
197.98	1,484
198.03	1,548
198.08	1,612
198.13	1,676
198.18	1,739
198.23	1,801
198.28	1,863
198.33	1,924
198.38	1,985
198.43	2,044
198.48	2,104
198.53	2,162
198.58	2,220
198.63	2,276
198.68	2,332
198.73	2,387
198.78	2,441
198.83	2,494
198.88	2,546
198.93	2,596
198.98	2,646
199.03	2,694
199.08	2,741
199.13	2,786
199.18	2,830
199.23	2,872
199.28	2,911
199.33	2,947
199.38	2,980
199.43	3,010
199.48	3,039
199.53	3,066
199.58	3,092
199.63	3,118
199.68	3,143
199.73	3,168
199.78	3,194
199.83	3,219
199.88	3,244
199.93	3,269
199.98	3,295
200.03	3,320
200.08	**3,345**

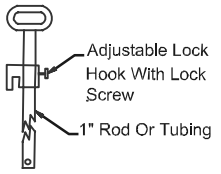
APPENDIX 'C' – FLOW CONTROL MANHOLE DETAIL



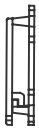
ELBOW DETAIL



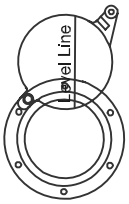
PLAN



LIFT HANDLE DETAIL

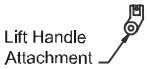


SIDE

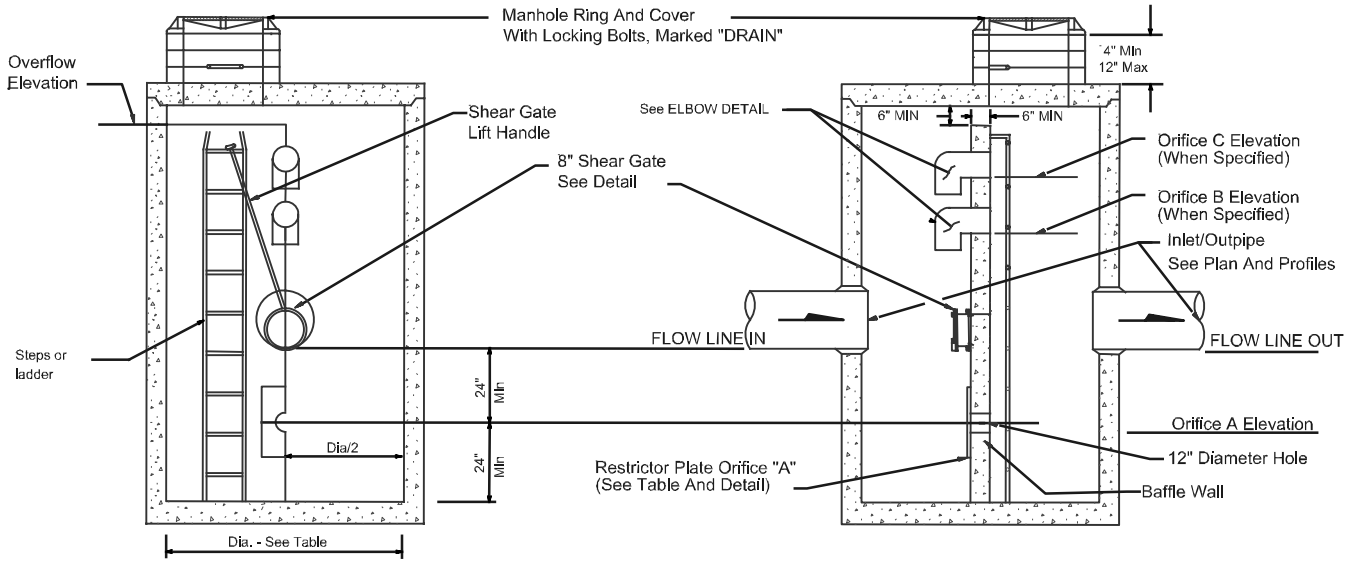


MAXIMUM OPENING
OF GATE DETAIL

FRONT



SHEAR GATE
AS MANUFACTURED BY KENNEDY VALVE OR EQUAL



SECTION A-A

ELEVATION

SECTION B-B

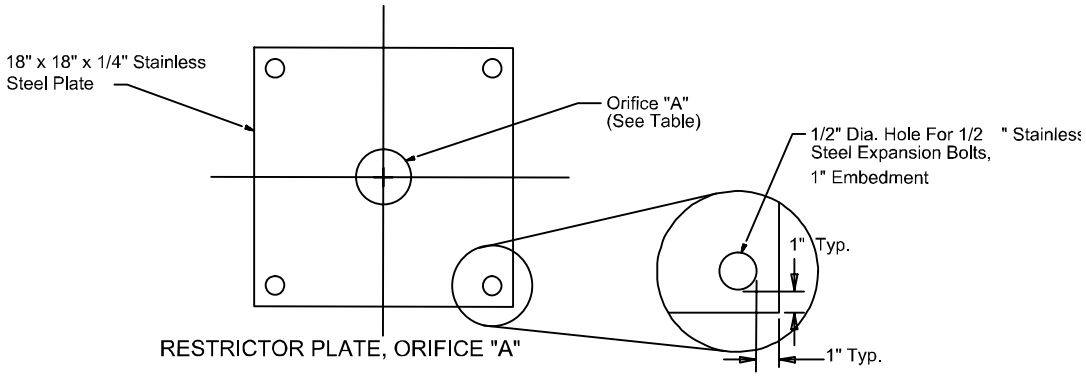
FLOW CONTROL STRUCTURE DETAIL
NTS

City of Newberg
PUBLIC WORKS ENGINEERING DIVISION
414 E. FIRST STREET NEWBERG, OR 97132
PHONE: 503-537-1240
FAX: 503-537-1277

REVISIONS:

FLOW CONTROL STRUCTURE

SCALE:	N.T.S.
DATE:	MARCH 2014
APPROVED BY:	JAY H.
STANDARD DRAWING	416A



RESTRICTOR PLATE, ORIFICE "A"

FLOW CONTROL STRUCUTRE TABLE-
DESIGN ENGINEER TO SPECIFIY

Diameter Of Manhole (In.)	
FLOW LINE (In)	
FLOW LINE (Out)	
Outlet Pipe Diameter (In.)	
Number Of Orifice	
Orifice A Elevation	
Diameter Of Orifice A (In.)	
Orifice B Elevation	
Diameter Of Orifice B (In.)	
Orifice C Elevation	
Diameter Of Orifice C (In)	
Overflow Elevation	
Rim Elevation	
Riser Diameter (In.)	

NOTES:

1. BAFFLE WALL SHALL HAVE #4 BAR AT 12" SPACING EACH WAY.
2. PRECAST BAFFLE SHALL BE KEYED AND GROUTED IN PLACE. JOINT BETWEEN CONCRETE BAFFLE AND MANHOLE WALL SHALL BE WATERTIGHT.
3. UPPER FLOW ORIFICE SHALL BE STAINLESS STEEL OR ALUMINUM.
4. FRAME AND LADDER OR STEPS ARE TO BE OFFSET SO THAT: SHEAR GATE IS VISIBLE FROM THE TOP; CLIMB-DOWN SPACE IS CLEAR OF RISER AND GATE; FRAME IS CLEAR OF CURB.
5. MULTI-ORIFICE ELBOWS SHALL BE PRE INSTALLED TO INSURE LADDER CLEARANCE.
6. RESTRICTOR PLATE WITH ORIFICE AS SPECIFIED IN THE CONTRACT. OPENING IS TO BE CUT ROUND AND SMOOTH. NEOPRENE GASKET SHALL BE INSTALLED BETWEEN THE ORIFICE PLATE AND CONCRETE BAFFLE TO PROVIDE A WATERTIGHT SEAL.
7. SHEAR GATE SHALL BE MADE OF ALUMINUM ALLOY IN ACCORDANCE WITH ASTM B 26M AND ASTM B 275, DESIGNATION Zg32A OR CAST IRON IN ACCORDANCE WITH ASTM A 48, CLASS 30B. LIFT HANDLE MAY BE SOLID ROD OR HOLLOW TUBING WITH ADJUSTABLE HOOK AS REQUIRED. NEOPRENE RUBBER GASKET REQUIRED BETWEEN RISER MOUNTING FLANGE AND GATE FLANGE. MATING SURFACES OF LID AND BODY SHALL BE MACHINED FOR PROPER FIT.
8. FLANGE MOUNTING BOLTS SHALL BE 1/2" DIAMETER STAINLESS STEEL.
9. SHEAR GATE MAXIMUM OPENING SHALL BE CONTROLLED BY LIMITED HINGE MOVEMENT, STOP TAB OR SOME OTHER DEVISE.
10. ALTERNATE SHEAR GATES DESIGNS ARE ACCEPTABLE, IF MATERIAL SPECIFICATIONS ARE MET AND FLANGE BOLT PATTERN MATCHES.
11. MANHOLE CERTIFICATION REQUIRED FOR TRAFFIC LOADING.

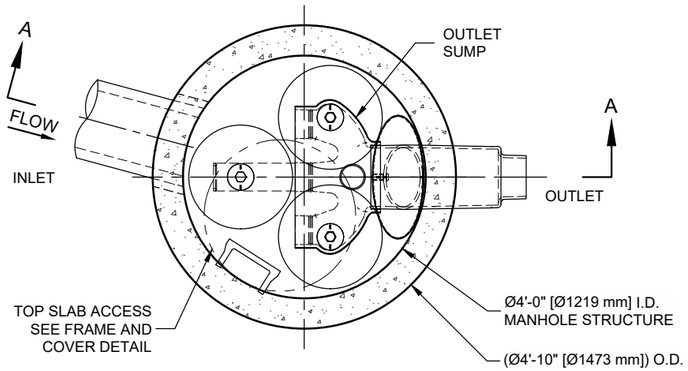
City of Newberg
PUBLIC WORKS ENGINEERING DIVISION
414 E. FIRST STREET NEWBERG, OR 97132
PHONE: 503-537-1240
FAX: 503-537-1277

REVISIONS:
05/05/2015 - ASM

FLOW CONTROL STRUCTURE NOTES & ORIFICE

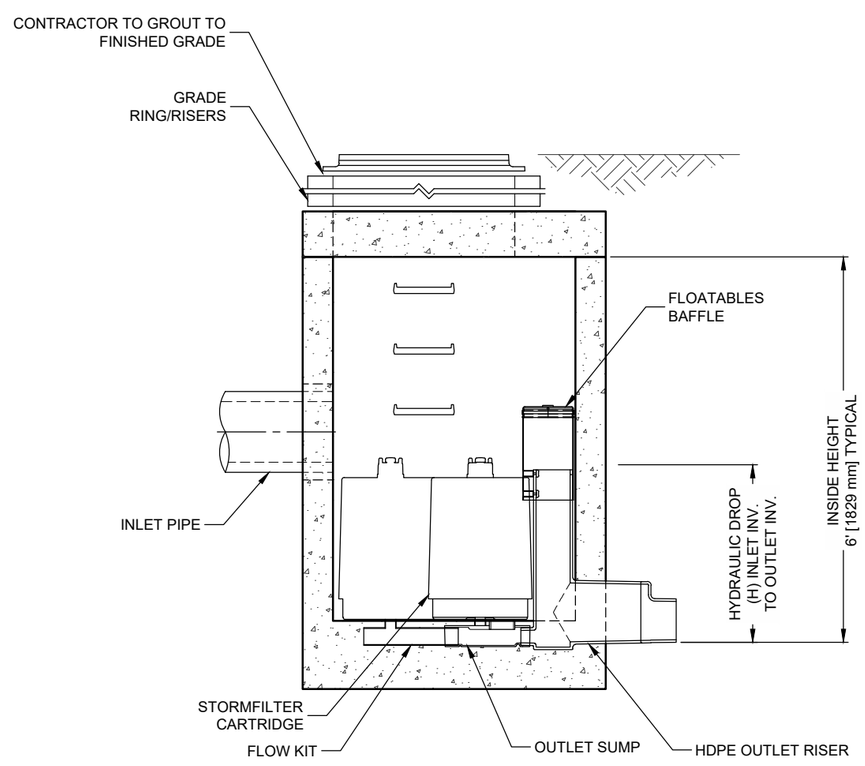
SCALE: N.T.S.
DATE: May 2015
APPROVED BY: K. Hofmann
STANDARD DRAWING 416B

APPENDIX 'D' – STORMFILTER MANHOLE DETAIL



PLAN VIEW

STANDARD OUTLET RISER
FLOWKIT: 40A



SECTION A-A

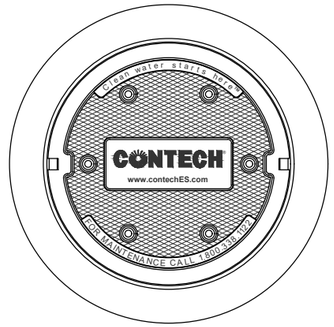
STORMFILTER DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (3). VOLUME SYSTEM IS ALSO AVAILABLE WITH MAXIMUM 3 CARTRIDGES.
Ø4 [1219 mm] MANHOLE STORMFILTER PEAK HYDRAULIC CAPACITY IS 1.0 CFS [28.3 L/s] . IF THE SITE CONDITIONS EXCEED 1.0 CFS [28.3 L/s] AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27" [686 mm]			18" [458 mm]			LOW DROP		
RECOMMENDED HYDRAULIC DROP (H)	3.05' [930 mm]			2.3' [700 mm]			1.8' [550 mm]		
SPECIFIC FLOW RATE (gpm/sf) [L/s/m^2]	2 [1.30]	1.67* [1.08]	1 [0.65]	2 [1.30]	1.67* [1.08]	1 [0.65]	2 [1.30]	1.67* [1.08]	1 [0.65]
CARTRIDGE FLOW RATE (gpm) [L/s]	22.5 [1.42]	18.79 [1.19]	11.25 [0.71]	15 [0.95]	12.53 [0.79]	7.5 [0.44]	10 [0.63]	8.35 [0.54]	5 [0.32]

* 1.67 gpm/sf [1.08 L/s/m^2] SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER

(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs) [L/s]	*
PEAK FLOW RATE (cfs) [L/s]	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
CARTRIDGE HEIGHT (SEE TABLE ABOVE)	*
NUMBER OF CARTRIDGES REQUIRED	*
CARTRIDGE FLOW RATE	*
MEDIA TYPE (PERLITE, ZPG, PSORB)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE #1	*	*	*
INLET PIPE #2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' [1524 mm] AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES [178 mm]. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
7. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) [L/s] DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft)[m^2].
8. STORMFILTER STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET PIPE(S).
E. CONTRACTOR TO PROVIDE AND INSTALL CONNECTOR TO THE OUTLET RISER STUB. STORMFILTER EQUIPPED WITH A DUAL DIAMETER HDPE OUTLET STUB AND SAND COLLAR. IF OUTLET PIPE IS LARGER THAN 8 INCHES [200 mm], CONTRACTOR TO REMOVE THE 8 INCH [200 mm] OUTLET STUB AT MOLDED-IN CUT LINE. COUPLING BY FERNCO OR EQUAL AND PROVIDED BY CONTRACTOR.
F. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

The Stormwater Management StormFilter®

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

SFMH48
STORMFILTER
STANDARD DETAIL

PIONEER DESIGN GROUP

SANTA BARBARA URBAN HYDROGRAPHS
(Water Quality Flow Rate - Number of Cartridges)

JOB NUMBER: 121-029
PROJECT: Newberg Apartments
FILE: 12129_hydro_planning

DESCRIPTION	DESIGN STORM (YR)	DURATION (HR)	PRECIP (IN)	AREA TOTAL (AC)	% IMP	AREA PERV. (AC)	CN PER.	AREA IMP. (AC)	CN IMP.	TIME (MIN)	Q (CFS)
DEVELOPED WQ-YEAR PEAK DISCHARGE	WQ	24	1	0.41	76.90	0.09	82.3	0.32	98	5.00	0.07

Assumptions:
Each storm filter manhole treats half of the site
1.67 gmp/sf
SF treated/cartridge = 5,936
18" Cartridge Height
Cartridge Flow Rate = 12.53 gpm (0.0278 cfs)

Number of cartridges required: .07 cfs/0.0278 cfs = 2.5 cartridges (use 3 cartridges)

APPENDIX 'E' – PRELIMINARY OPERATIONS & MAINTENANCE PLAN

Preliminary Operations & Maintenance Plan

The Haworth

Newberg, OR 97132

November 7, 2022

Prepared For:

Grove Development, Inc.
7570 SW 74th Avenue
Portland, Oregon 97223
503.793.3299

Prepared By:

Pioneer Design Group, Inc.
9020 SW Washington Sq. Rd., Suite 170
Portland, Oregon 97223
503.643.8286

STORMWATER FACILITIES

Water quality and quantity treatment will occur through trapped catch basins, filtration manholes and underground detention chambers.

- Underground Storage Chamber
  - Underground storage chambers are a proprietary structure made of corrugated plastics by ADS. Stormwater from the roof of the apartment building is piped to the facility where it is detained and released at the respective predeveloped rate.

- Stormfilter Manholes
  - Stormfilter manholes are proprietary treatment device made by Contech Engineering Solutions that use cartridges to filter and treat stormwater runoff. Two manholes will treat runoff from the building roof, sidewalks and parking lot.

FACILITY DESCRIPTION TABLE					
Facility Name	**Type**	**Size (SF)**	**Area Treated**	**IA Treated (SF)**	**Discharge Point**
Chamber	Underground Storage Chamber	(7 Rows of 7 Chambers)	Roof, Sidewalk, Parking Lot, Landscape Area	27,472	Existing Public Storm System
SFMH-1	Stormfilter Cartridge Manhole	48" Dia. (3 cartridges)	Roof, Sidewalk, Parking Lot	13,736	Existing Public Storm System
SFMH-2	Stormfilter Cartridge Manhole	48" Dia. (3 cartridges)	Roof, Sidewalk, Parking Lot	13,736	Existing Public Storm System

RESPONSIBILITY

The facility is to be maintained by Grove Development, Inc. (owner). The preparer has worked closely with the owner to design a system that can be easily maintained by their maintenance staff and employees.

Under The City of Newberg's surface water code, responsibilities include:

- Maintain stormwater management facilities in good condition, with facilities operating at design capacity and performing the function for which they were designed while in continuous working order.

- Inspect and maintain at an appropriate frequency and level to avoid nuisance conditions in or adjacent to the stormwater management facility that suggest that the facility is not

in good working order, such as uncontrolled runoff and overflow, stagnant water with concomitant algae growth, insect breeding, odors, discarded debris, or safety hazards created by the facility's operation.

- Inspect stormwater facilities according to the schedule included in the maintenance checklists provided in this manual or a facility-specific OMP.

- Promptly repair and restore stormwater management facilities in accordance with the maintenance checklists provided in this manual.

- Provide and maintain all necessary access routes from the public right-of-way in accordance with this manual or the OMP.

A copy of this O&M Plan shall be provided to all property owners and tenants.

I. DESCRIPTION

Stormwater runoff from the apartment roof, sidewalk, parking lot and landscape areas will be conveyed to the Stormfilter Manholes for treatment prior to being discharged into the underground storage chambers for via a piped storm system network. A flow control manhole will attenuate developed flows to their respective predeveloped flow rates before being discharged to a public 24-inch storm main located on the north boundary of the subject site. Stormwater from the parking lot will be collected in trapped catch basins for pretreatment upstream of the filtration manholes. *See attached site plan.*

II. INSPECTION and VISUAL INDICATORS OF DIMINISHED PERFORMANCE

The underground storage facilities shall be inspected and maintained quarterly for the first two years, after which they shall be inspected twice a year thereafter. The facilities shall also be inspected within 48 hours after each major storm event (defined as more than one inch of rain over a 24-hour period).

All components of the storm system must be inspected and maintained frequently or they will cease to function effectively. The property owner shall keep a facility log, recording all inspection dates, observations, and maintenance activities. Receipts shall be saved when maintenance is performed and there is a record of expense.

For at least the first two years, inspections shall be conducted with the facility drawings and the O&M Plan in hand to assist the inspector in recognizing signs of diminished performance.

Typical visual indicators of diminished performance are listed below:

- Clogged inlets, catch basins, or silt traps.

- Cracked drain pipes or catch basins.
- Vegetation encroachment.
- Ponding water.

III. MAINTENANCE ACTIVITIES

The following items shall be inspected and maintained as stated:

Underground Storage Chambers

- The underground storage chambers should initially be inspected immediately after completion of the site's construction.
- Remove sediment and debris from all accessible components.
- See attached Storage ADS StormTech Chamber Inspection and Stormfilter Maintenance Guide.

Catch Basins, Inlets, Gutters, and Piped Storm System

- Sediment shall be removed biannually.
- Debris shall be removed from catch basins quarterly or after any large rain event (more than one inch of rain over a 24-hour period).
- Quarterly inspection for clogging shall be performed. Remove sediment, debris and blockages to maintain at least 50% conveyance at all times.
- Repair or seal cracks in drain pipes, catch basins, or silt traps. Replace when repair is insufficient.

Source Control

- Remove trash, debris and sediment from driveway or surrounding property as required.
- Identify sources of visible pollutants and clean up immediately.
- Sweep or vacuum ground level surfaces biannually.
- Rake and remove fallen or dead leaves and vegetation seasonally.

Spill Prevention

- Releases of pollutants or pollutant source shall be corrected within 12 hours.
- Remove and replace contaminated soil. Call Metro (503-797-1700) to determine proper disposal requirements of spill response materials and contaminated soil.
- Report spills of hazardous materials to City staff (503-635-0238).
- Record the date and spill response measures in the inspection log.
- Clean up spills immediately.

Insects and Rodents

- Pest control measures shall be taken when insects are problematic.

- If sprays are considered, they shall be applied only by a licensed contractor. Only sprays approved by the City of Newberg shall be allowed.
- If rodents are found, remove plant debris, fruits or nuts that provide food and shelter and contact the appropriate county vector control office for trapping and removal.

Access

- Access shall be provided to the facility so operations and maintenance can be performed as regularly scheduled.

IV. FINANCIAL RESPONSIBILITY

The party listed below shall be fiscally responsible for operating and maintaining the stormwater facility:

Grove Development, Inc.
7570 SW 74th Avenue
Portland, Oregon 97223
(p) 503-793-3299

V. INSPECTION AND MAINTENANCE LOGS

Infiltration/Flow Control – All facilities shall drain within 48 hours. Time/date, weather, and site conditions shall be recorded when ponding occurs.

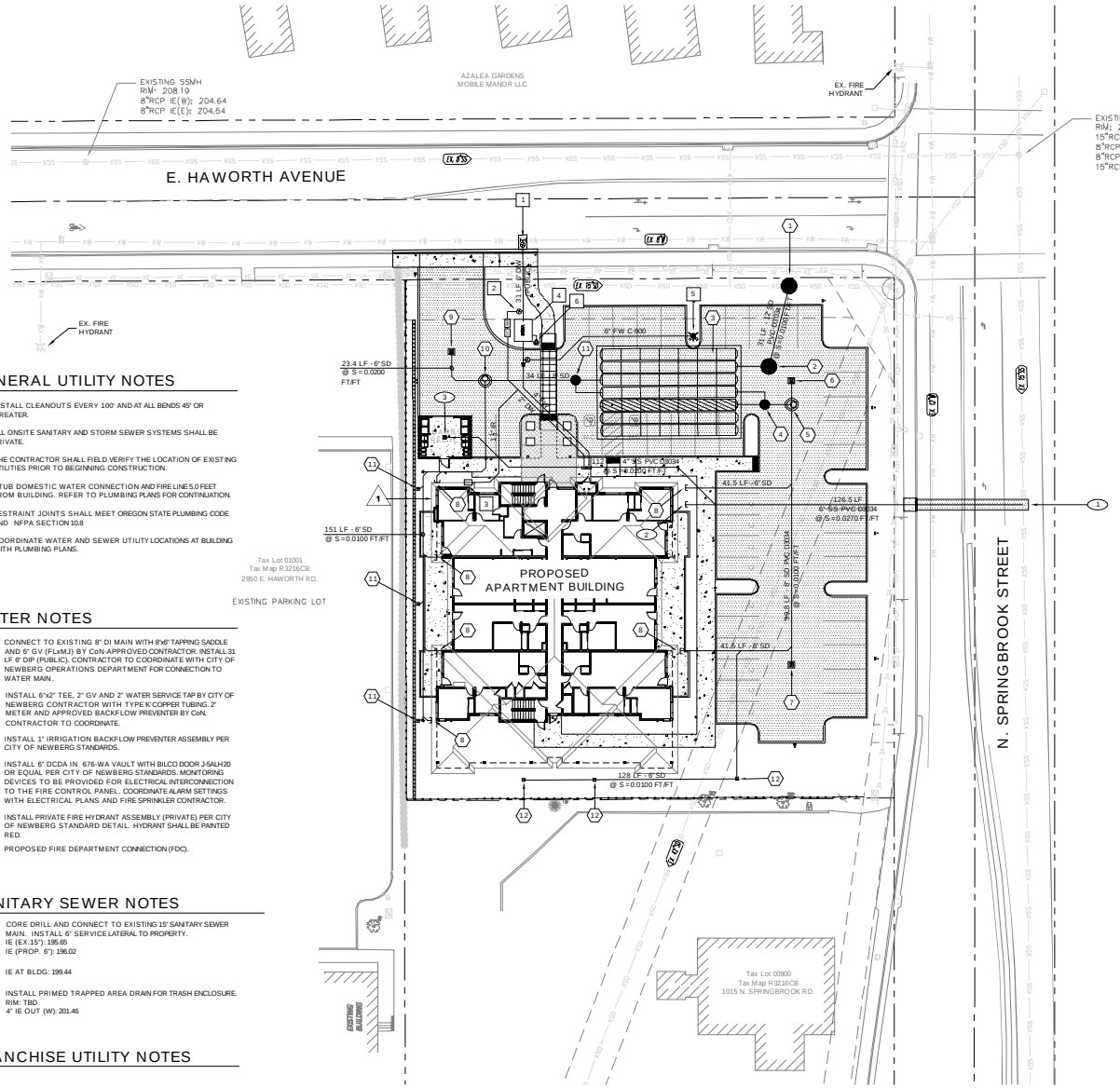
Pollution Prevention – All sites shall implement best management practices to prevent hazardous wastes, litter, or excessive oil and sediment from contaminating stormwater. Contact City of Maintenance Department (503-538-8321) for immediate assistance with responding to spills. Record time/date, weather, and site conditions if site activities are found to contaminate sanitary or storm system.

Vectors (mosquitoes and rodents) – Stormwater facilities shall not harbor mosquito larvae or rats that pose a threat to public health or that undermine the facility structure. Note holes/burrows in and around facilities. Record time/date, weather, and site conditions when vector activity is observed.

Maintenance – Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout services.

General Annual Maintenance Schedule

- Make structural repairs. Clean drains, inlets, and catch basins (**Summer**)
- Clean downspouts and rain drains; remove sediment and plant debris (**Fall**)
- Clear inlets and outlets to maintain conveyance (**Winter**)
- Clean gutters and rain drains (**Spring**)



GENERAL UTILITY NOTES

1. INSTALL CLEANOUTS EVERY 100' AND AT ALL BENDS 45° OR GREATER.
2. ALL ONSITE SANITARY AND STORM SEWER SYSTEMS SHALL BE PRIVATE.
3. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF EXISTING UTILITIES PRIOR TO BEGINNING CONSTRUCTION.
4. STUB DOMESTIC WATER CONNECTION AND FIRE LINE 5.0 FEET FROM BUILDING. REFER TO PLUMBING PLANS FOR CONTINUATION.
5. RESTRAINT JOINTS SHALL MEET OREGON STATE PLUMBING CODE AND NFPA SECTION 10.8
6. COORDINATE WATER AND SEWER UTILITY LOCATIONS AT BUILDING WITH PLUMBING PLANS.

WATER NOTES

1. CONNECT TO EXISTING 8" DI MAIN WITH 8"x6" TAPPING SADDLE AND 6" GV (FLxMJ) BY CoN-APPROVED CONTRACTOR. INSTALL 31 LF 6" DIP (PUBLIC). CONTRACTOR TO COORDINATE WITH CITY OF NEWBERG OPERATIONS DEPARTMENT FOR CONNECTION TO WATER MAIN.
2. INSTALL 6"x2" TEE, 2" GV AND 2" WATER SERVICE TAP BY CITY OF NEWBERG CONTRACTOR WITH TYPE K COPPER TUBING. 2" METER AND APPROVED BACKFLOW PREVENTER BY CoN. CONTRACTOR TO COORDINATE.
3. INSTALL 1" IRRIGATION BACKFLOW PREVENTER ASSEMBLY PER CITY OF NEWBERG STANDARDS.
4. INSTALL 6" DCDA IN 676-WA VAULT WITH BILCO DOOR J-5ALH20 OR EQUAL PER CITY OF NEWBERG STANDARDS. MONITORING DEVICES TO BE PROVIDED FOR ELECTRICAL INTERCONNECTION TO THE FIRE CONTROL PANEL. COORDINATE ALARM SETTINGS WITH ELECTRICAL PLANS AND FIRE SPRINKLER CONTRACTOR.
5. INSTALL PRIVATE FIRE HYDRANT ASSEMBLY (PRIVATE) PER CITY OF NEWBERG STANDARD DETAIL. HYDRANT SHALL BE PAINTED RED.
6. PROPOSED FIRE DEPARTMENT CONNECTION (FDC).

SANITARY SEWER NOTES

1. CORE DRILL AND CONNECT TO EXISTING 15" SANITARY SEWER MAIN. INSTALL 6" SERVICE LATERAL TO PROPERTY.
   IE (EX.15"): 195.65
   IE (PROP. 6"): 196.02
2. IE AT BLDG: 199.44
3. INSTALL PRIMED TRAPPED AREA DRAIN FOR TRASH ENCLOSURE.
   RIM: TBD
   4" IE OUT (W): 201.46

FRANCHISE UTILITY NOTES

1. PROPOSED ELECTRIC METERS. FINAL DESIGN BY OTHERS.

LEGEND

- DW — PROPOSED DOMESTIC WATER LINE
- FW — PROPOSED FIRE SERVICE LINE
- DCDA — PROPOSED DOUBLE CHECK DETECTOR ASSEMBLY
- PROPOSED CLEANOUT
- PROPOSED TRAPPED CATCH BASIN
- PROPOSED LANDSCAPE DRAIN
- SS — PROPOSED SANITARY SEWER LINE
- SD — PROPOSED STORM DRAIN LINE
- PROPOSED FIRE HYDRANT
- PROPOSED FIRE DEPARTMENT CONNECTION (FDC)
- PROPOSED WATER AND IRRIGATION METER
- DC — PROPOSED DOUBLE CHECK ASSEMBLY
- DCDA — PROPOSED DOUBLE CHECK DETECTOR ASSEMBLY
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORMFILTER MANHOLE
- PROPOSED UNDERGROUND DETENTION CHAMBERS

STORM SEWER NOTES

1. INSTALL 60" Ø MANHOLE OVER EXISTING 24" STORM SEWER LINE.
   RIM = 203.87
   EX. 24" IE IN (E) = 193.85
   12" IE IN (SW) = 194.65
   EX. 241" IE OUT (W) = 193.65
2. INSTALL 60" FLOW CONTROL MANHOLE.
   RIM = TBD
   12" IE IN (W) = 194.96
   12" IE OUT (NE) = 194.96
3. 7 ROWS OF 7 UNDERGROUND DETENTION CHAMBERS (STORMTECH ADS SC-740)
   6" ROCK BASE, 6" ROCK COVER
   ROCK BOTTOM ELEV = 196.58
   CHAMBER BOTTOM ELEV = 197.08
4. INSTALL 30" Ø NYLOPLAST DRAIN BASIN (STANDARD AASHTO H-20 GRATE)
   INSTALL 11 LF 24" ACCESS PIPE WITH 10" MANIFOLD
   RIM = TBD
   10" IE IN (E) = 198.35
   10" IE OUT (N) = 198.35
   24" IE OUT (W) = 197.18
5. CONSTRUCT 48"Ø WATER QUALITY STORMFILTER MANHOLE (SFMH-1). (3-18" CARTRIDGES)
   RIM:TBD
   6" IE IN (N): 200.75
   8" IE IN (S): 200.75
   10" IE OUT (W): 198.45
6. CONSTRUCT TRAPPED CATCH BASIN
   INSTALL 8 LF 6" PVC D3034
   RIM: 204.06
   6" IE OUT (S): 200.56
7. CONSTRUCT TRAPPED CATCH BASIN
   INSTALL 180 LF 8" PVC D3034
   RIM: 204.63
   8" IE OUT (N): 201.75
8. CONNECT TO BUILDING ROOF DRAIN WITH 6" SD AT 2.0% MIN.
9. CONSTRUCT TRAPPED CATCH BASIN
   INSTALL 23.4 LF 6" PVC D3034
   RIM: 205.02
   6" IE OUT (S): 201.63
10. CONSTRUCT 48"Ø WATER QUALITY STORMFILTER MANHOLE (SFMH-2). (3-18" CARTRIDGES)
    RIM:TBD
    6" IE IN (W): 201.16
    6" IE IN (S): 201.16
    10" IE OUT (E): 198.86
11. INSTALL 30" Ø NYLOPLAST DRAIN BASIN (STANDARD AASHTO H-20 GRATE)
    INSTALL 11 LF 24" ACCESS PIPE WITH 10" MANIFOLD
    RIM = TBD
    8" IE IN (W) = 198.52
    10" IE OUT (S) = 198.35
    24" IE OUT (E) = 197.18
12. CONSTRUCT 12" SQ. LANDSCAPE AREA DRAIN WITH ATRIUM GRATE (ADS PART NOS. 1200, 1290, AND 1242 OR EQUAL).
13. CONSTRUCT 12" SQ. LANDSCAPE AREA DRAIN WITH ATRIUM GRATE (ADS PART NOS. 1200, 1290, AND 1242 OR EQUAL).

SCALE
20 0 10 20
1 INCH = 20 FEET

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PRELIMINARY

PRELIMINARY COMPOSITE UTILITY PLAN

THE HAWORTH APPARTMENTS
NEWBERG, OREGON

	By	Revisions	Date	No.
Designed by	LM		11/2022	
Drawn by	LM		11/2022	
Reviewed by	MLS		REF:	
Project No.	121-029			
Horiz. Scale:				
Vert. Scale:				

Project: NEWBERG APPARTMENTS
No. 121-029
Type PLANNING
Sheet P5.0

Operations and Maintenance Log
(The Haworth Apartments)

Date	Work Performed By	Type of Work Performed				Notes	Initials
		Sediment and Trash Removal (inlets and catch basins)	Structural Repairs (type, location)	Clean Downspouts and and Rain Drains	Vegetation Removal		

13.0 Inspection and Maintenance

13.1 TREATMENT TRAIN INSPECTION AND MAINTENANCE

The StormTech recommended treatment train inlet system has three tiers of treatment upstream of the StormTech chambers. It is recommended that inspection and maintenance (I&M) be initiated at the furthest upstream treatment tier and continue downstream as necessary. The following I&M procedures follow this approach providing I&M information in the following order: Tier 1 – Pretreatment (BMP); Tier 2 – StormTech Isolator Row, and ; Tier 3 – Eccentric Pipe Header System.

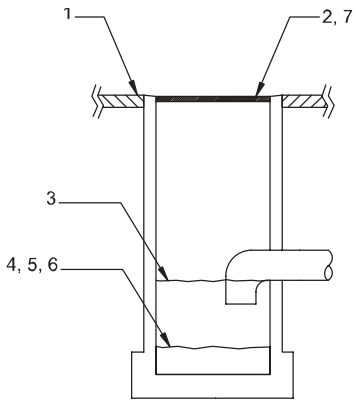
13.2 CATCHBASIN/MANHOLE I&M

Typically a stormwater system will have catchbasins and manholes upstream of the detention/retention system. In some cases these may be the only pre-treatment devices. Regular I&M of catchbasins and manholes should be scheduled and performed as part of a site's routine maintenance plan.

Catchbasin/Manhole – Step-by-Step Maintenance Procedures

1) Inspect catch basins and manholes upstream of StormTech chambers for sediment
2) Remove grate or cover
3) Skim off oils and floatables
4) Using a stadia rod, measure the depth of sediment
5) If sediment is at a depth greater than 6" proceed to step 6. If not proceed to step 7.
6) Vacuum or manually remove sediment
7) Replace grate
8) Record depth & date and schedule next inspection

Figure 17 – Catchbasin/Manhole I&M Steps



13.3 PRE-TREATMENT DEVICE I&M

Manufacturer's I&M procedures should be followed for proprietary pretreatment devices such as baffle boxes, swirl concentrators, oil-water separators, and filtration units. **Table 10** provides some general guidelines but is not a substitute for a manufacturer's specific instructions.

TABLE 10 – Pretreatment Inspection and Maintenance Guidelines

SEDIMENT CONTROL INSPECTION	INSPECTION*	MAINTENANCE**
StormTech Isolator™ Row	Bi-Annually	JetVac - Culvert Cleaning Nozzle Preferred
Sediment Basin	Quarterly or after large storm event	Excavate sediment
Catch Basin Sump	Quarterly	Excavate,pump, or vacuum
Sedimentation Structure	Quarterly	Excavate,pump, or vacuum
Catch Basin Filter Bags	After all storm events	Clean and/or replace filter bags
Porous Pavement	Quarterly	Sweep Pavement
Pipe Header Design	Quarterly	Excavate,pump, or vacuum
Water Quality Inlet	Quarterly	Excavate,pump, or vacuum
Sand Filters	Quarterly or after storm event	Remove & replace sand filter

13.0 Inspection & Maintenance

13.4 ISOLATOR™ ROW INSPECTION

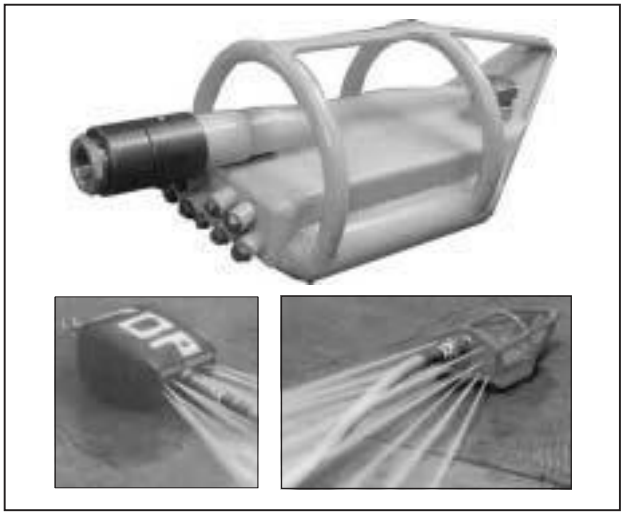
Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a confined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3 inches, cleanout is required.

A StormTech Isolator Row should initially be inspected immediately after completion of the site's construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site's owner. Once in normal service, a StormTech Isolator Row should be inspected bi-annually until an understanding of the sites characteristics is developed. The site's maintenance manager can then revise the inspection schedule based on experience or local requirements.

13.5 ISOLATOR ROW MAINTENANCE

JetVac maintenance is required if sediment has been collected to an average depth of 3 inches or more inside the Isolator Row. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have a minimum of 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. The JetVac process shall only be performed on StormTech Rows that have AASHTO class 1 woven geotextile over their angular base stone.



STORMTECH ISOLATOR™ ROW - STEP-BY-STEP MAINTENANCE PROCEDURES

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry

2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

Step 2) Clean out Isolator Row using the JetVac process

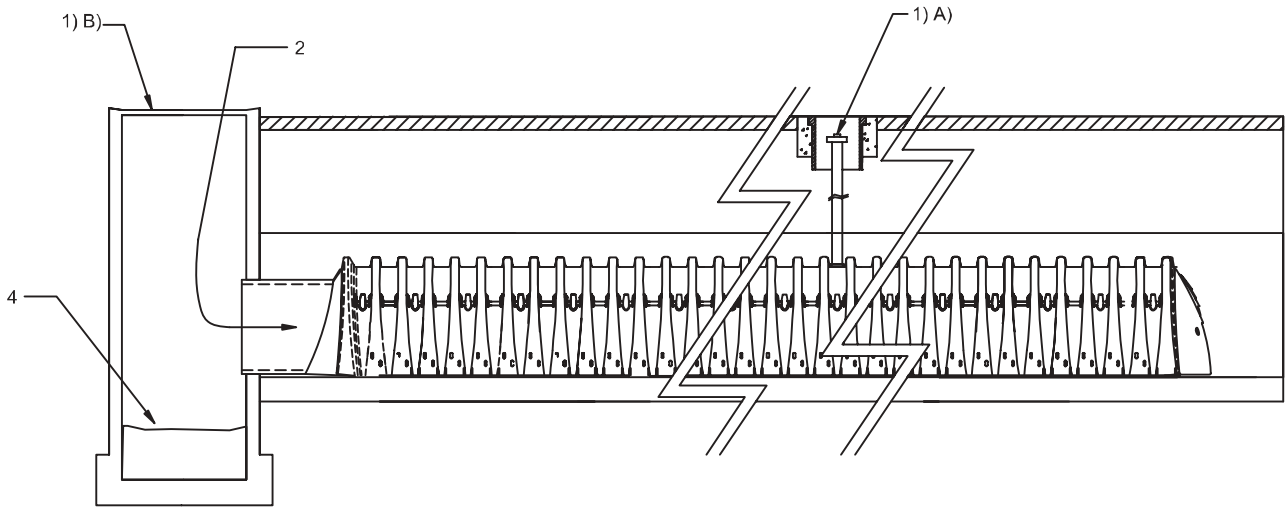
A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system following the procedures for Classic Manifold Inlet System

Figure 18

StormTech Isolator Row (not to scale)



13.0 Inspection & Maintenance

13.6 ECCENTRIC PIPE HEADER INSPECTION

Theses guidelines do not supercede a pipe manufacturer's recommended I&M procedures. Consult with the manufacturer of the pipe header system for specific I&M procedures. Inspection of the header system should be carried out quarterly. On sites which generate higher levels of sediment more frequent inspections may be necessary. Headers may be accessed through risers, access ports or manholes. Measurement of sediment may be taken with a stadia rod or similar device. Cleanout of sediment should occur when the sediment volume has reduced the storage area by 25% or the depth of sediment has reached approximately 25% of the diameter of the structure.

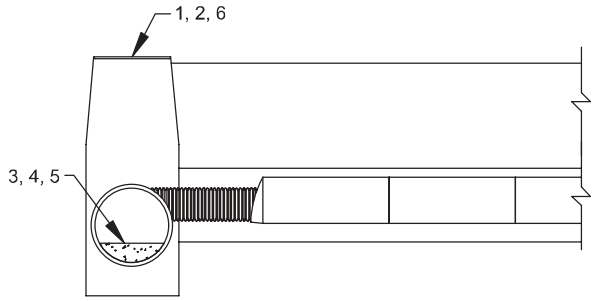
13.7 ECCENTRIC PIPE HEADER MAINTENANCE

Cleanout of accumulated material should be accomplished by vacuum pumping the material from the header. Cleanout should be accomplished during dry weather. Care should be taken to avoid flushing sediments out through the outlet pipes and into the chamber rows.

Eccentric Header Step-by-Step Maintenance Procedures

1. Locate manholes, access ports or risers connected to the header system
2. Remove grates or covers
3. Using a stadia rod, measure the depth of sediment
4. If sediment is at a depth of about 25% pipe volume or 25% pipe diameter proceed to step 5. If not proceed to step 6.
5. Vacuum pump the sediment. Do not flush sediment out inlet pipes.
6. Replace grates and covers
7. Record depth & date and schedule next inspection

Figure 19 – Manifold Maintenance



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.

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.

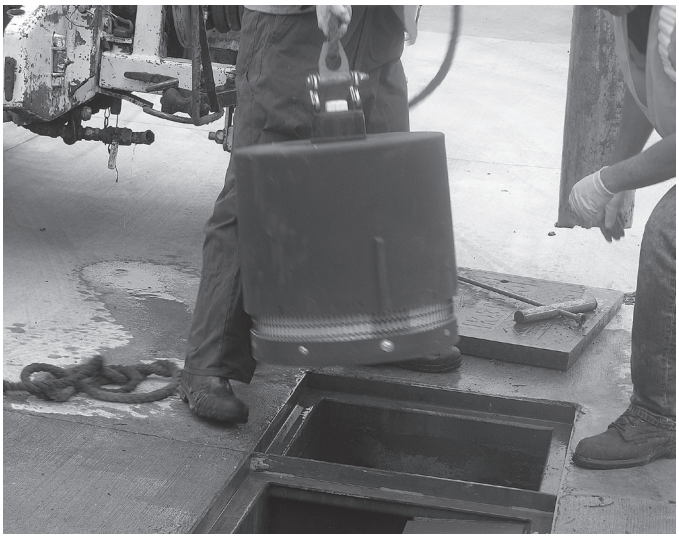
Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste 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.

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.



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:

_____

_____

_____

_____

_____

_____

_____

_____

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: _____

_____

_____

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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- Site-specific design support is available from our engineers.