Preliminary Stormwater Management Plan

Downtown Lee's Summit Apartments

115 S.E. Main Street
Section: SE ¼ Sec. 6-47-31
Lee's Summit, Missouri

Prepared by:

PLANNING
ENGINEERING
IMPLEMENTATION

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PEI #171125
December 20, 2018

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A. Treatment & Detention

- Existing Drainage Map A1
- Proposed Drainage Map A2
- Proposed HydroCAD Model Results
- NRCS Web Soil Survey

B. Details & Calculations

- Detention Design Details (to be included with final report)

1. INTRODUCTION

This report is a preliminary stormwater management plan for the proposed Downtown Lee's Summit Apartment development prepared by Phelps Engineering, Inc. (PEI) on behalf of the developer – Cityscape Residential, LLC.

The proposed site is bounded by SE Main Street (public) to the west, SE 1st Street to the north (public), SE Douglas Street (public) to the east, and SE 2nd Street (public) to the south. The proposed development is approximately 3.73 acres and consists of multi-family apartment units, a parking garage, and an existing church which will be re-purposes as a leasing office.

The property lies within Zone X, defined as areas determined to be outside the 0.2% annual chance floodplain, as shown on the flood insurance rate map prepared by the Federal Emergency Management Agency for the City of Lee's Summit, Community No. 290174, Jackson County, Missouri, Map No. 29095C0417G, and dated January 20, 2017.

See the Vicinity Map below.

Figure 1 - Vicinity Map

2. STORMWATER REQUIREMENTS

Stormwater design criteria are in accordance with City of Lee's Summit Technical Specifications and Design Criteria and APWA 5600.

Onsite detention shall be provided, for the increase in impervious area, for the 2-year, 10-yr, and 100-year rainfall events that meet the APWA Comprehensive Control discharge rates.

All storm sewers shall be sized to convey the 25-year design storm.

3. EXISTING SITE CONDITIONS

The existing site is developed and consists of urban land, upland soils. No NRCS Hydrologic Soil Group (HSG) is provided for this soil type. Therefore, a HSG of D has been assumed for conservative purposes. See Appendix A of this report for the NRCS Web Soil Survey for the site.

The existing site consists of open space in good condition and paved areas (parking, sidewalks, and buildings), corresponding to CN values of 80 and 98 for Type D soils. The existing site surface drains southeasterly where it is captured by existing curb inlets along SE 2nd Street. The existing site consists of 114,837 S.F. of impervious area. See Appendix A of this report for Existing Drainage A1.

4. PROPOSED SITE CONDITIONS

The proposed site consists of a combination of open space in good condition and paved areas (parking, sidewalks, and buildings) corresponding to CN values of 80 and 98, respectively, for Type D soils. The proposed site will maintain the existing drainage pattern. Stormwater will be conveyed from the proposed site via an enclosed underground private stormwater system and connect to the existing public stormwater system along SE 2nd Street. The proposed site consists of 124,154 S.F. of impervious area. This represents an increase in impervious area of 9,317 S.F. from the existing conditions. See Appendix A of this report for Proposed Drainage Map A2.

5. STORMWATER DETENTION

Detention shall be provided for the increase in impervious area, 9,317 S.F (0.21 acres). A portion of the proposed apartment buildings, equaling the increase in impervious area, will be routed to an underground detention system located in the courtyard of the apartment complex. The underground detention system consists of 9 MC-4500 Stormtech Chambers and 2 end caps. An outlet control structure with flow control orifices will be located directly downstream of the detention system. The detention system and outlet control system is sized to control the discharge for the 2-year, 10-year, and 100-year storm events to the APWA allowable discharge rates per City of Lee's Summit requirements.

Table 1 – APWA Allowable Discharge

Storm Event	Allowable Discharge (cfs)		
	Site Area (acres)	Discharge Rate (cfs)	Discharge (cfs)
2-Year	0.21	0.5	0.11
10-Year	0.21	2.0	0.42
100-Year	0.21	3.0	0.63

Table 2 – Proposed Runoff Conditions

Drainage Sub-Basin	Open Space (acres)	Impervious (acres)	Total (acres)	Composite CN	Time of Conc. (min)
Detention	0.00	0.21	0.21	98	5

Using HydroCAD, the 2-year, 10-year, and 100-year peak discharges from the proposed detention basin were determined and are shown in Table 3 below. The proposed 2-year, 10-year, and 100-year detention basin results are shown in Table 4 below. See Appendix A of this report for proposed PondPack calculations.

Table 3 – Proposed Runoff Results

Storm Event	APWA[1] Allowable Discharge (cfs)	Peak Overall (cfs)	Peak Discharge Rate (cfs/acre)
1-Year	0.11	0.10	0.48
10-Year	0.42	0.39	1.86
100-Year	0.63	0.63	3.00

[1] – See Table 1 for allowable discharge calculations.

Table 4 – Proposed Detention Basin Results

Basin	Storm Event	Detention Inflow (cfs)	Detention Outflow (cfs)	Maximum WSEL Above Bottom off Storage (ft.)	Maximum Storage (cf)
Detention	2-Year	1.09	0.10	2.78’	955
	10-Year	1.67	0.39	3.99’	1,390
	100-Year	2.43	0.63	6.47’	2,058

The proposed detention basin results in proposed flows less than the APWA allowable release rates for the 2-year, 10-year, and 100-year events meeting the City of Lee’s Summit detention requirements. Design details for the underground detention basin will be included with the Final Stormwater Management Plan.

6. CONCLUSION

This report and attached appendices complete Phelps Engineering Inc.’s submittal of the Preliminary Stormwater Management Plan for the Downtown Lee’s Summit Apartments. Please feel free to contact PEI at (913) 393-1155 if you require additional information.

Sincerely,

PHELPS ENGINEERING, INC.

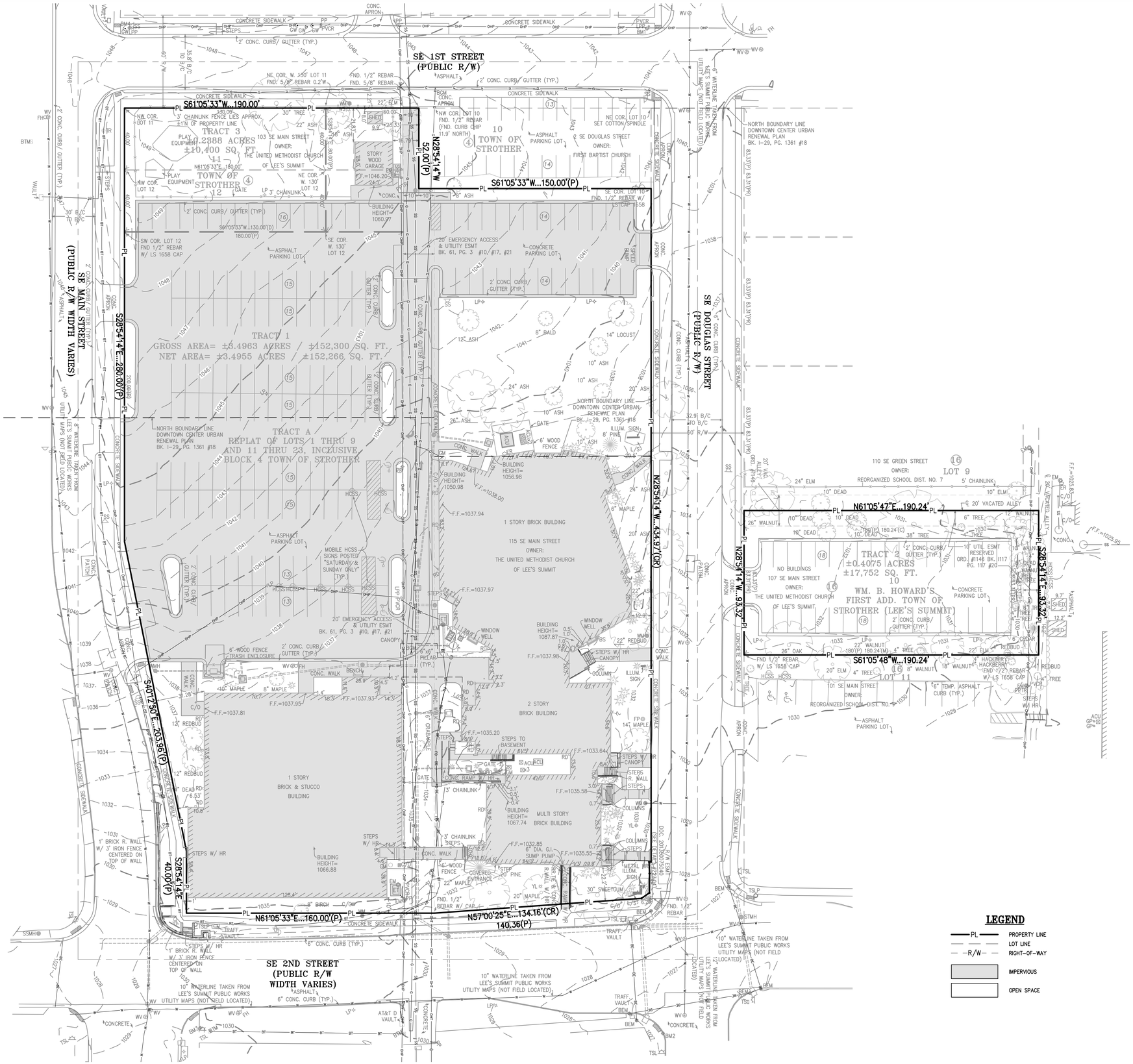
Judd D. Claussen, P.E.

Enclosures

APPENDIX A

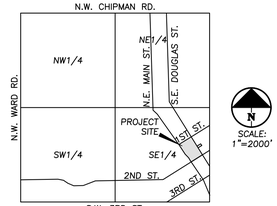
Treatment & Detention

- Existing Drainage Map A1
- Proposed Drainage Map A2
- Proposed HydroCAD Model
- NRCS Web Soil Survey



UTILITY NOTES:
VISUAL INDICATIONS OF UTILITIES ARE AS SHOWN. UNDERGROUND LOCATIONS SHOWN, AS FURNISHED BY THEIR LESSORS, ARE APPROXIMATE AND SHOULD BE VERIFIED IN THE FIELD AT THE TIME OF CONSTRUCTION. FOR ACTUAL FIELD LOCATIONS OF UNDERGROUND UTILITIES CALL 811.

EXISTING IMPERVIOUS AREA = 114,837 S.F.



VICINITY MAP
SEC. 6–T47N–R31W

LEGEND

PL	PROPERTY LINE
	LOT LINE
R/W	RIGHT-OF-WAY
	IMPERVIOUS
	OPEN SPACE

TOTAL LOTS (3) = 180,452 S.F. (4.1426 ACRES)

IMPERVIOUS = 125,691 S.F. (2.8855 ACRES)

OPEN SPACE = 54,761 S.F. (1.2571 ACRES)

SCALE: 1"=30'
0' 30' 60'

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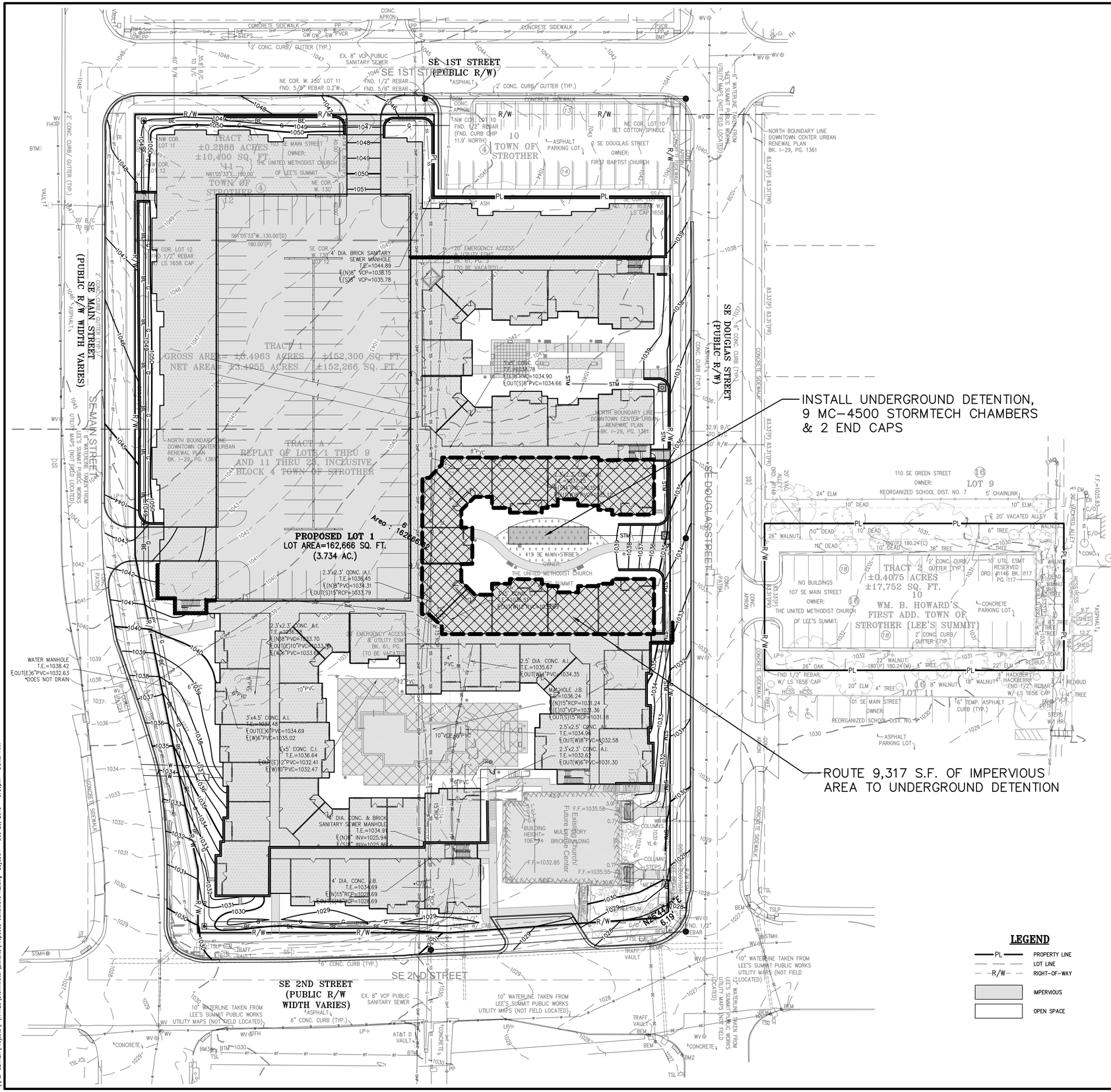
EXISTING CONDITIONS MAP
LEE'S SUMMIT APARTMENTS
115 S.E. MAIN STREET
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

No.	Date	Revisions:	By	App.

PROJECT NO. 171125
DATE: 12-17-18 DRAWN: SNH
CHECKED: DAF APPROVED: DJC
CERTIFICATE OF AUTHORIZATION KANSAS ENGINEERING - LS-82
ENGINEERING - E-301
CERTIFICATE OF AUTHORIZATION MISSOURI SURVEYING - 2007001128
ENGINEERING - 2007002508

SHEET
A1



811 Know what's below. Call before you dig.

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PROPOSED CONDITIONS MAP
LEE'S SUMMIT APARTMENTS
115 S.E. MAIN STREET
LEE'S SUMMIT, JACKSON COUNTY, MISSOURI

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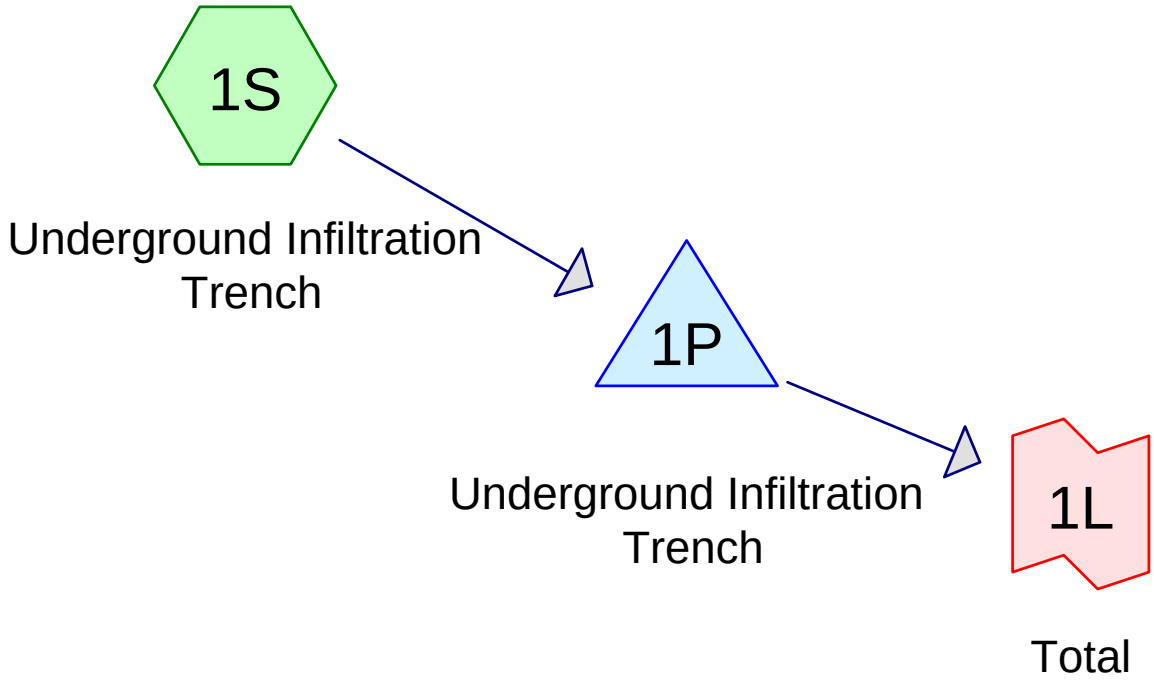
KANSAS ENGINEERING - LS-82
ENGINEERING - E-361
CERTIFICATE OF AUTHORIZATION
MISSOURI ENGINEERING - 2007001128
ENGINEERING - 2007002508

SHEET
A2

\\PEI-SERVER\Projects\P\171125\Stormwater\Exhibits\Proposed Conditions A2.dwg Layout:1 Dec 20, 2018 - 9:56pm Daniel Fine



Subcat Reach Pond Link

Routing Diagram for Proposed
Prepared by Microsoft, Printed 12/19/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.214	98	Paved parking, HSG D (1S)
0.214	**98**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.214	HSG D	1S
0.000	Other	
0.214		**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	0.214	0.000	0.214	Paved parking	1S
0.000	**0.000**	**0.000**	**0.214**	**0.000**	**0.214**	**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	1P	97.00	96.00	100.0	0.0100	0.013	15.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Underground Runoff Area=9,317 sf 100.00% Impervious Runoff Depth=5.06"
Tc=5.0 min CN=98 Runoff=1.67 cfs 0.090 af

Pond 1P: Underground Infiltration Trench Peak Elev=103.99' Storage=1,390 cf Inflow=1.67 cfs 0.090 af
Outflow=0.39 cfs 0.090 af

Link 1L: Total Inflow=0.39 cfs 0.090 af
Primary=0.39 cfs 0.090 af

Total Runoff Area = 0.214 ac Runoff Volume = 0.090 af Average Runoff Depth = 5.06"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.214 ac

Summary for Subcatchment 1S: Underground Infiltration Trench

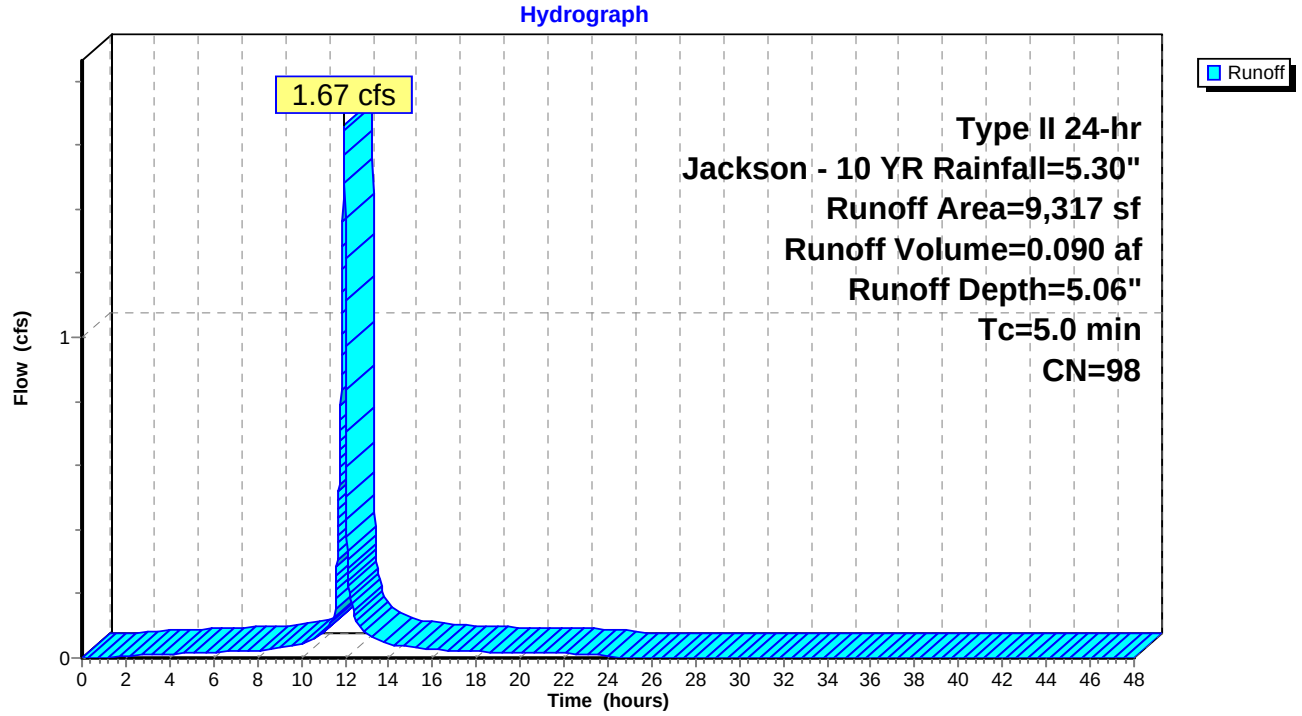
Runoff = 1.67 cfs @ 11.96 hrs, Volume= 0.090 af, Depth= 5.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr Jackson - 10 YR Rainfall=5.30"

Area (sf)	CN	Description
9,317	98	Paved parking, HSG D
9,317		100.00% Impervious Area

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

Subcatchment 1S: Underground Infiltration Trench



Hydrograph for Subcatchment 1S: Underground Infiltration Trench

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.03	0.00	0.00
1.00	0.06	0.00	0.00
1.50	0.09	0.01	0.00
2.00	0.12	0.02	0.01
2.50	0.15	0.04	0.01
3.00	0.18	0.06	0.01
3.50	0.22	0.08	0.01
4.00	0.25	0.11	0.01
4.50	0.29	0.14	0.01
5.00	0.33	0.17	0.01
5.50	0.38	0.21	0.02
6.00	0.42	0.25	0.02
6.50	0.47	0.29	0.02
7.00	0.52	0.34	0.02
7.50	0.58	0.39	0.02
8.00	0.64	0.44	0.02
8.50	0.70	0.50	0.03
9.00	0.78	0.58	0.03
9.50	0.86	0.66	0.04
10.00	0.96	0.75	0.04
10.50	1.08	0.87	0.06
11.00	1.25	1.03	0.08
11.50	1.50	1.28	**0.13**
12.00	3.51	3.28	**1.37**
12.50	3.90	3.66	0.12
13.00	4.09	3.86	0.07
13.50	4.23	4.00	0.06
14.00	4.35	4.11	0.04
14.50	4.44	4.20	0.04
15.00	4.52	4.29	0.03
15.50	4.60	4.36	0.03
16.00	4.66	4.43	0.03
16.50	4.72	4.49	0.03
17.00	4.78	4.54	0.02
17.50	4.83	4.60	0.02
18.00	4.88	4.64	0.02
18.50	4.93	4.69	0.02
19.00	4.97	4.73	0.02
19.50	5.01	4.77	0.02
20.00	5.05	4.81	0.02
20.50	5.08	4.84	0.01
21.00	5.11	4.88	0.01
21.50	5.15	4.91	0.01
22.00	5.18	4.94	0.01
22.50	5.21	4.97	0.01
23.00	5.24	5.00	0.01
23.50	5.27	5.03	0.01
24.00	**5.30**	**5.06**	0.01
24.50	5.30	5.06	0.00
25.00	5.30	5.06	0.00
25.50	5.30	5.06	0.00
26.00	5.30	5.06	0.00
26.50	5.30	5.06	0.00
27.00	5.30	5.06	0.00
27.50	5.30	5.06	0.00
28.00	5.30	5.06	0.00
28.50	5.30	5.06	0.00
29.00	5.30	5.06	0.00
29.50	5.30	5.06	0.00
30.00	5.30	5.06	0.00
30.50	5.30	5.06	0.00
31.00	5.30	5.06	0.00
31.50	5.30	5.06	0.00
32.00	5.30	5.06	0.00
32.50	5.30	5.06	0.00
33.00	5.30	5.06	0.00
33.50	5.30	5.06	0.00
34.00	5.30	5.06	0.00
34.50	5.30	5.06	0.00
35.00	5.30	5.06	0.00
35.50	5.30	5.06	0.00
36.00	5.30	5.06	0.00
36.50	5.30	5.06	0.00
37.00	5.30	5.06	0.00
37.50	5.30	5.06	0.00
38.00	5.30	5.06	0.00
38.50	5.30	5.06	0.00
39.00	5.30	5.06	0.00
39.50	5.30	5.06	0.00
40.00	5.30	5.06	0.00
40.50	5.30	5.06	0.00
41.00	5.30	5.06	0.00
41.50	5.30	5.06	0.00
42.00	5.30	5.06	0.00
42.50	5.30	5.06	0.00
43.00	5.30	5.06	0.00
43.50	5.30	5.06	0.00
44.00	5.30	5.06	0.00
44.50	5.30	5.06	0.00
45.00	5.30	5.06	0.00
45.50	5.30	5.06	0.00
46.00	5.30	5.06	0.00
46.50	5.30	5.06	0.00
47.00	5.30	5.06	0.00
47.50	5.30	5.06	0.00
48.00	5.30	5.06	0.00

Summary for Pond 1P: Underground Infiltration Trench

Inflow Area = 0.214 ac,100.00% Impervious, Inflow Depth = 5.06" for Jackson - 10 YR event
Inflow = 1.67 cfs @ 11.96 hrs, Volume= 0.090 af
Outflow = 0.39 cfs @ 12.09 hrs, Volume= 0.090 af, Atten= 77%, Lag= 8.0 min
Primary = 0.39 cfs @ 12.09 hrs, Volume= 0.090 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 103.99' @ 12.09 hrs Surf.Area= 556 sf Storage= 1,390 cf

Plug-Flow detention time= 69.8 min calculated for 0.090 af (100% of inflow)
Center-of-Mass det. time= 69.8 min (811.8 - 742.0)

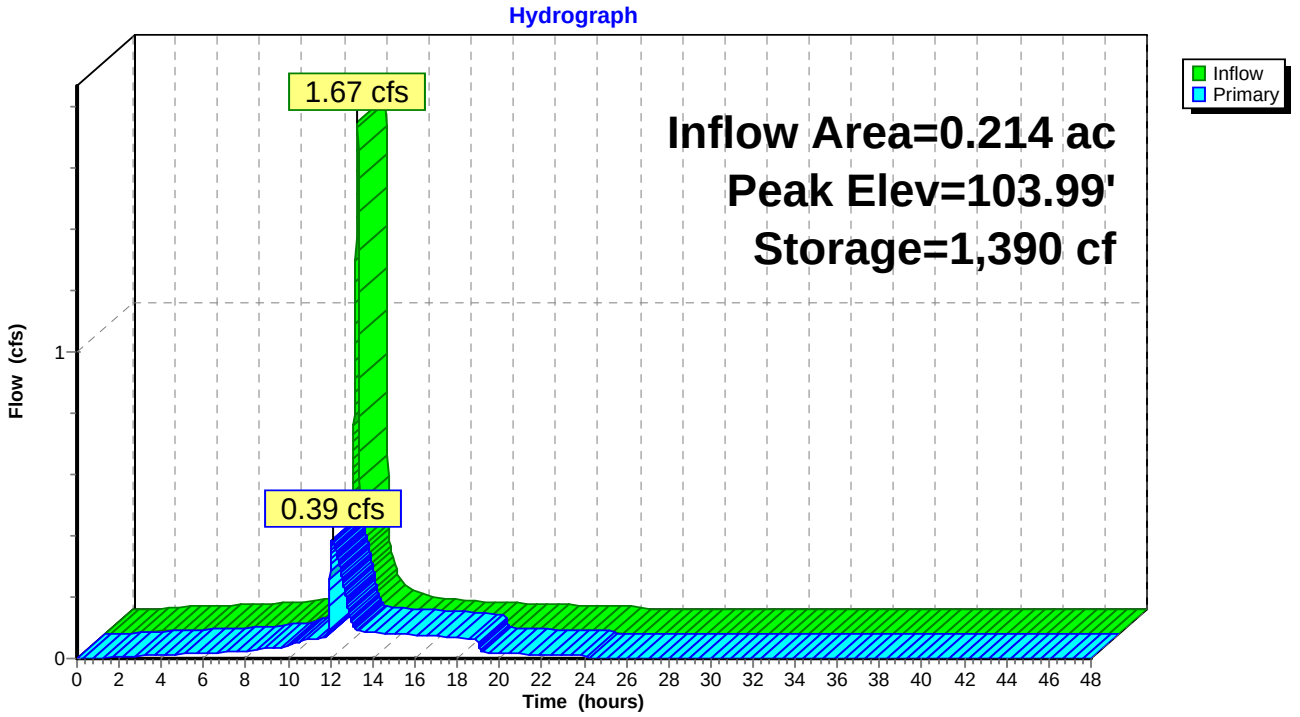
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,091 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 3,759 cf Overall - 1,031 cf Embedded = 2,728 cf x 40.0% Voids
#2	100.75'	1,031 cf	**ADS_StormTech MC-4500 +Cap @ 4.03' L** x 9 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.6 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
		2,122 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	556	0	0
106.76	556	3,759	3,759

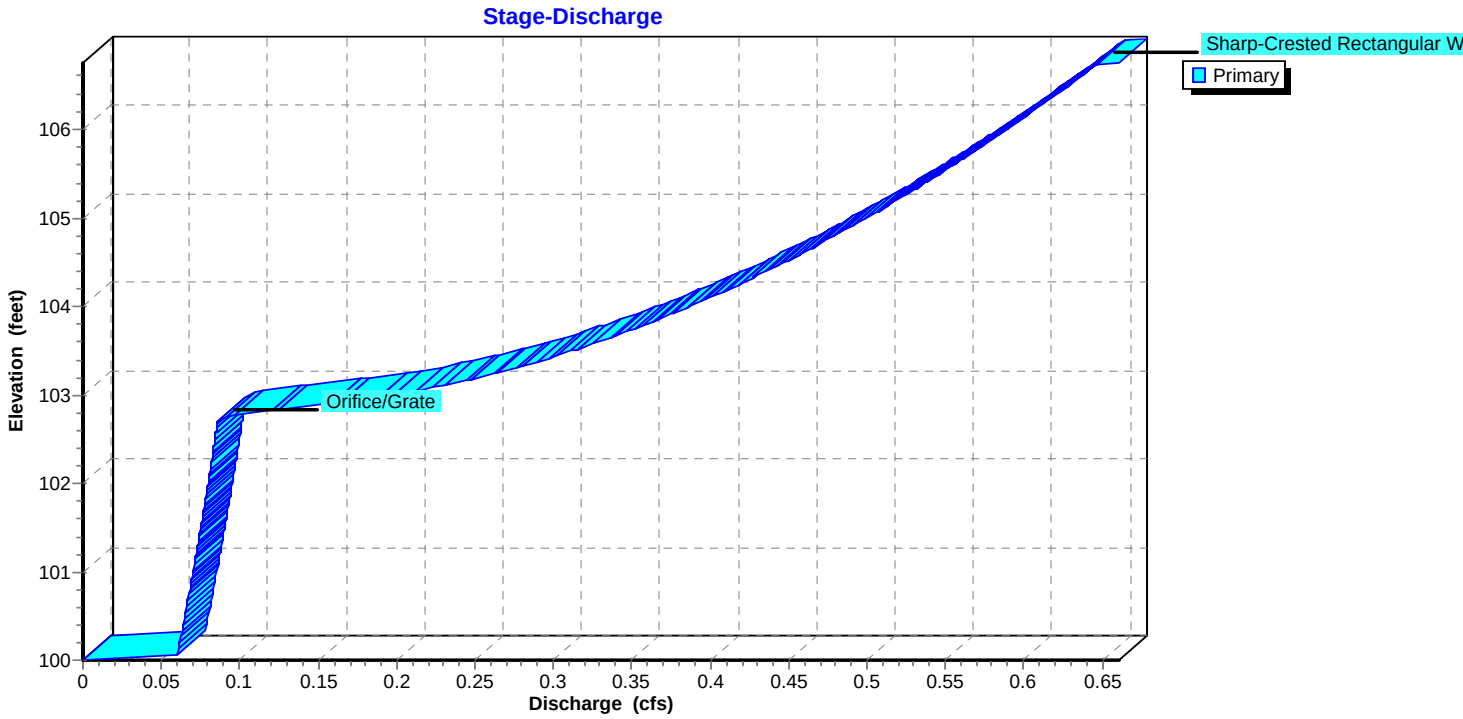
Device	Routing	Invert	Outlet Devices
#1	Primary	97.00'	**15.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 97.00' / 96.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	106.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	97.50'	**1.2" Vert. Orifice/Grate** C= 0.600
#4	Device 1	102.70'	**3.2" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.39 cfs @ 12.09 hrs HW=103.99' (Free Discharge)
└**1=Culvert** (Passes 0.39 cfs of 13.07 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 0.10 cfs @ 12.22 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.29 cfs @ 5.19 fps)

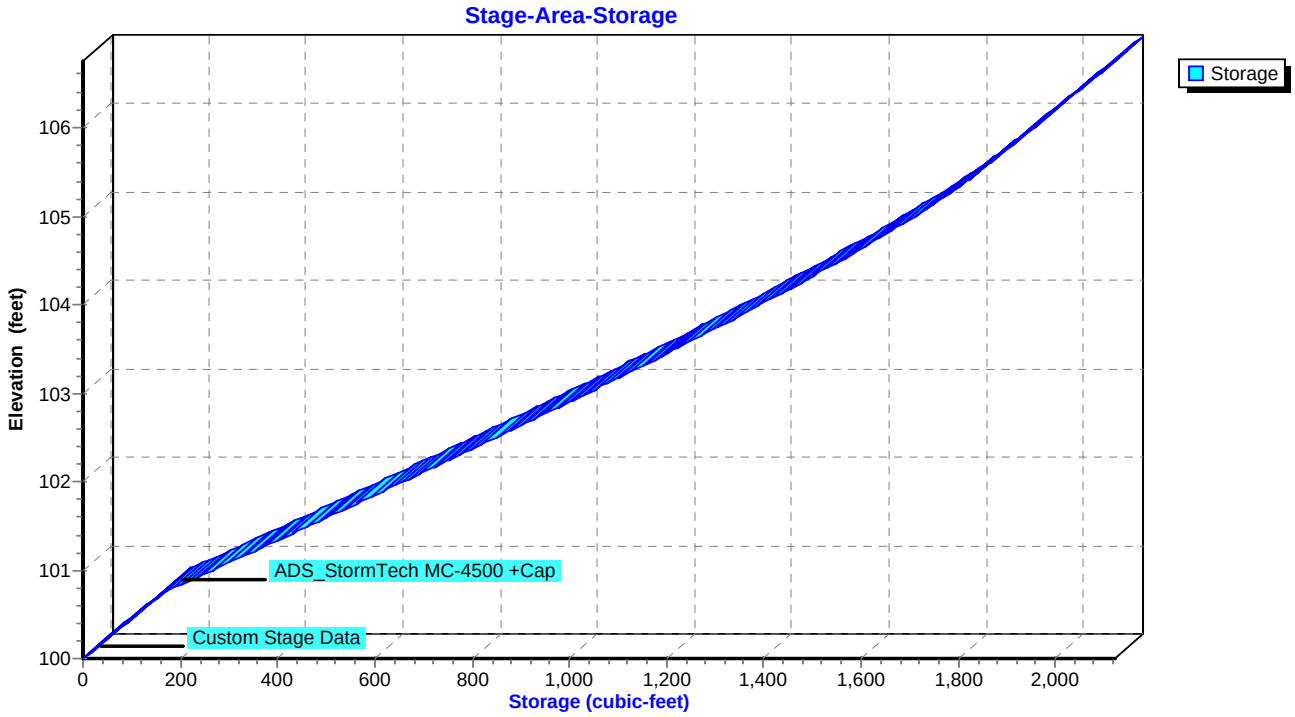
Pond 1P: Underground Infiltration Trench



Pond 1P: Underground Infiltration Trench



Pond 1P: Underground Infiltration Trench



Hydrograph for Pond 1P: Underground Infiltration Trench

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	100.00	0.00
1.00	0.00	0	100.00	0.00
2.00	0.01	1	100.01	0.01
3.00	0.01	2	100.01	0.01
4.00	0.01	3	100.01	0.01
5.00	0.01	4	100.02	0.01
6.00	0.02	4	100.02	0.02
7.00	0.02	5	100.02	0.02
8.00	0.02	6	100.03	0.02
9.00	0.03	8	100.04	0.03
10.00	0.04	10	100.05	0.04
11.00	**0.08**	26	100.12	0.06
12.00	**1.37**	**1,247**	**103.58**	**0.33**
13.00	0.07	**971**	**102.82**	**0.12**
14.00	0.04	853	102.51	0.08
15.00	0.03	696	102.10	0.08
16.00	0.03	524	101.65	0.08
17.00	0.02	346	101.20	0.07
18.00	0.02	174	100.77	0.07
19.00	0.02	13	100.06	0.05
20.00	0.02	4	100.02	0.02
21.00	0.01	4	100.02	0.01
22.00	0.01	3	100.02	0.01
23.00	0.01	3	100.01	0.01
24.00	0.01	3	100.01	0.01
25.00	0.00	0	100.00	0.00
26.00	0.00	0	100.00	0.00
27.00	0.00	0	100.00	0.00
28.00	0.00	0	100.00	0.00
29.00	0.00	0	100.00	0.00
30.00	0.00	0	100.00	0.00
31.00	0.00	0	100.00	0.00
32.00	0.00	0	100.00	0.00
33.00	0.00	0	100.00	0.00
34.00	0.00	0	100.00	0.00
35.00	0.00	0	100.00	0.00
36.00	0.00	0	100.00	0.00
37.00	0.00	0	100.00	0.00
38.00	0.00	0	100.00	0.00
39.00	0.00	0	100.00	0.00
40.00	0.00	0	100.00	0.00
41.00	0.00	0	100.00	0.00
42.00	0.00	0	100.00	0.00
43.00	0.00	0	100.00	0.00
44.00	0.00	0	100.00	0.00
45.00	0.00	0	100.00	0.00
46.00	0.00	0	100.00	0.00
47.00	0.00	0	100.00	0.00
48.00	0.00	0	100.00	0.00

Stage-Discharge for Pond 1P: Underground Infiltration Trench

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
100.00	0.00	102.12	0.08	104.24	0.42	106.36	0.62
100.04	0.06	102.16	0.08	104.28	0.42	106.40	0.62
100.08	0.06	102.20	0.08	104.32	0.43	106.44	0.62
100.12	0.06	102.24	0.08	104.36	0.43	106.48	0.63
100.16	0.06	102.28	0.08	104.40	0.44	106.52	0.63
100.20	0.06	102.32	0.08	104.44	0.44	106.56	0.63
100.24	0.06	102.36	0.08	104.48	0.44	106.60	0.64
100.28	0.06	102.40	0.08	104.52	0.45	106.64	0.64
100.32	0.06	102.44	0.08	104.56	0.45	106.68	0.64
100.36	0.06	102.48	0.08	104.60	0.46	106.72	0.64
100.40	0.06	102.52	0.08	104.64	0.46	106.76	**0.66**
100.44	0.06	102.56	0.08	104.68	0.47		
100.48	0.06	102.60	0.08	104.72	0.47		
100.52	0.07	102.64	0.09	104.76	0.47		
100.56	0.07	102.68	0.09	104.80	0.48		
100.60	0.07	102.72	0.09	104.84	0.48		
100.64	0.07	102.76	0.09	104.88	0.49		
100.68	0.07	102.80	0.11	104.92	0.49		
100.72	0.07	102.84	0.12	104.96	0.50		
100.76	0.07	102.88	0.15	105.00	0.50		
100.80	0.07	102.92	0.17	105.04	0.50		
100.84	0.07	102.96	0.18	105.08	0.51		
100.88	0.07	103.00	0.20	105.12	0.51		
100.92	0.07	103.04	0.21	105.16	0.51		
100.96	0.07	103.08	0.22	105.20	0.52		
101.00	0.07	103.12	0.23	105.24	0.52		
101.04	0.07	103.16	0.24	105.28	0.53		
101.08	0.07	103.20	0.25	105.32	0.53		
101.12	0.07	103.24	0.26	105.36	0.53		
101.16	0.07	103.28	0.27	105.40	0.54		
101.20	0.07	103.32	0.28	105.44	0.54		
101.24	0.07	103.36	0.29	105.48	0.54		
101.28	0.07	103.40	0.29	105.52	0.55		
101.32	0.07	103.44	0.30	105.56	0.55		
101.36	0.07	103.48	0.31	105.60	0.55		
101.40	0.07	103.52	0.32	105.64	0.56		
101.44	0.07	103.56	0.32	105.68	0.56		
101.48	0.07	103.60	0.33	105.72	0.56		
101.52	0.08	103.64	0.33	105.76	0.57		
101.56	0.08	103.68	0.34	105.80	0.57		
101.60	0.08	103.72	0.35	105.84	0.58		
101.64	0.08	103.76	0.35	105.88	0.58		
101.68	0.08	103.80	0.36	105.92	0.58		
101.72	0.08	103.84	0.36	105.96	0.59		
101.76	0.08	103.88	0.37	106.00	0.59		
101.80	0.08	103.92	0.38	106.04	0.59		
101.84	0.08	103.96	0.38	106.08	0.60		
101.88	0.08	104.00	0.39	106.12	0.60		
101.92	0.08	104.04	0.39	106.16	0.60		
101.96	0.08	104.08	0.40	106.20	0.60		
102.00	0.08	104.12	0.40	106.24	0.61		
102.04	0.08	104.16	0.41	106.28	0.61		
102.08	0.08	104.20	0.41	106.32	0.61		

Stage-Area-Storage for Pond 1P: Underground Infiltration Trench

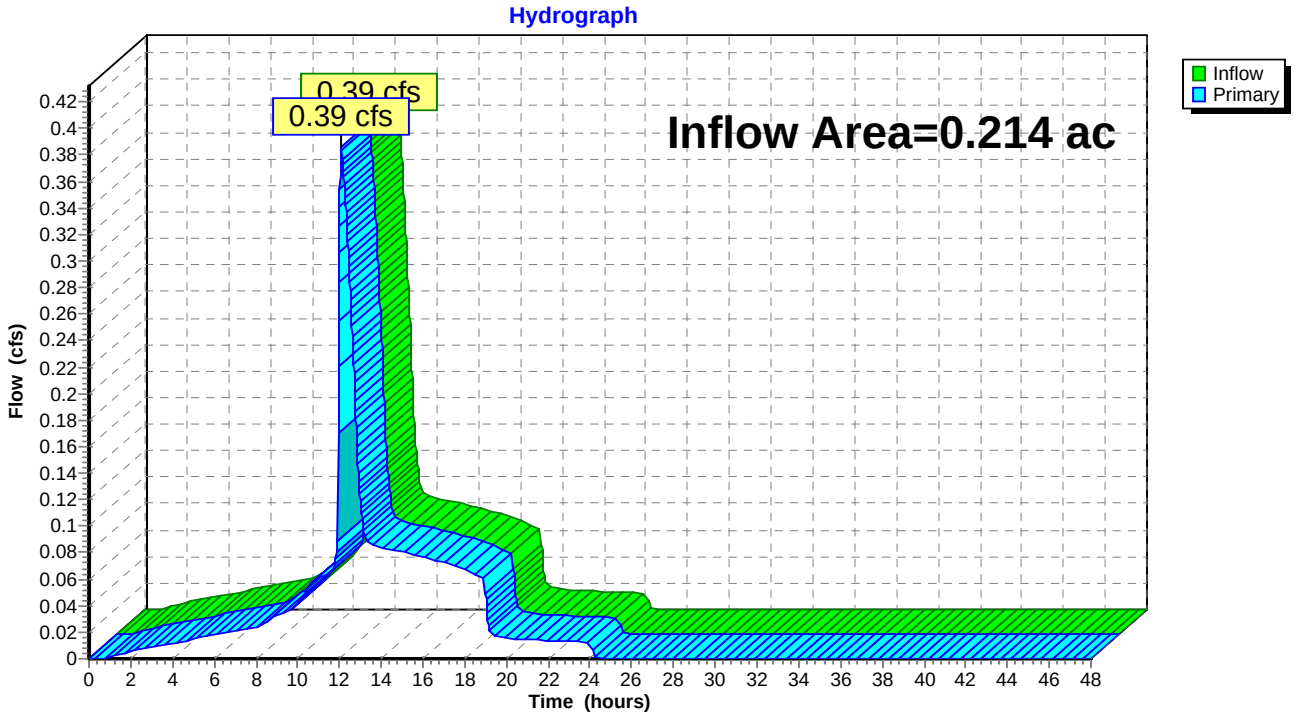
Elevation (feet)	Storage (cubic-feet)
100.00	0
100.10	22
100.20	44
100.30	67
100.40	89
100.50	111
100.60	133
100.70	156
100.80	187
100.90	227
101.00	266
101.10	306
101.20	345
101.30	385
101.40	424
101.50	464
101.60	503
101.70	542
101.80	581
101.90	620
102.00	658
102.10	697
102.20	735
102.30	774
102.40	812
102.50	850
102.60	887
102.70	925
102.80	962
102.90	999
103.00	1,036
103.10	1,073
103.20	1,110
103.30	1,146
103.40	1,182
103.50	1,218
103.60	1,253
103.70	1,288
103.80	1,323
103.90	1,358
104.00	1,392
104.10	1,426
104.20	1,459
104.30	1,492
104.40	1,525
104.50	1,557
104.60	1,589
104.70	1,620
104.80	1,650
104.90	1,680
105.00	1,710
105.10	1,738
105.20	1,765
105.30	1,792
105.40	1,816
105.50	1,840
105.60	1,863
105.70	1,886
105.80	1,909
105.90	1,931
106.00	1,953
106.10	1,975
106.20	1,997
106.30	2,020
106.40	2,042
106.50	2,064
106.60	2,086
106.70	**2,109**

Summary for Link 1L: Total

Inflow Area = 0.214 ac,100.00% Impervious, Inflow Depth = 5.06" for Jackson - 10 YR event
Inflow = 0.39 cfs @ 12.09 hrs, Volume= 0.090 af
Primary = 0.39 cfs @ 12.09 hrs, Volume= 0.090 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: Total



Hydrograph for Link 1L: Total

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
0.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00
2.00	0.01	0.00	0.01
2.50	0.01	0.00	0.01
3.00	0.01	0.00	0.01
3.50	0.01	0.00	0.01
4.00	0.01	0.00	0.01
4.50	0.01	0.00	0.01
5.00	0.01	0.00	0.01
5.50	0.02	0.00	0.02
6.00	0.02	0.00	0.02
6.50	0.02	0.00	0.02
7.00	0.02	0.00	0.02
7.50	0.02	0.00	0.02
8.00	0.02	0.00	0.02
8.50	0.03	0.00	0.03
9.00	0.03	0.00	0.03
9.50	0.04	0.00	0.04
10.00	0.04	0.00	0.04
10.50	0.05	0.00	0.05
11.00	0.06	0.00	0.06
11.50	0.06	0.00	0.06
12.00	**0.33**	0.00	**0.33**
12.50	**0.28**	0.00	**0.28**
13.00	0.12	0.00	0.12
13.50	0.09	0.00	0.09
14.00	0.08	0.00	0.08
14.50	0.08	0.00	0.08
15.00	0.08	0.00	0.08
15.50	0.08	0.00	0.08
16.00	0.08	0.00	0.08
16.50	0.07	0.00	0.07
17.00	0.07	0.00	0.07
17.50	0.07	0.00	0.07
18.00	0.07	0.00	0.07
18.50	0.06	0.00	0.06
19.00	0.05	0.00	0.05
19.50	0.02	0.00	0.02
20.00	0.02	0.00	0.02
20.50	0.01	0.00	0.01
21.00	0.01	0.00	0.01
21.50	0.01	0.00	0.01
22.00	0.01	0.00	0.01
22.50	0.01	0.00	0.01
23.00	0.01	0.00	0.01
23.50	0.01	0.00	0.01
24.00	0.01	0.00	0.01
24.50	0.00	0.00	0.00
25.00	0.00	0.00	0.00
25.50	0.00	0.00	0.00
26.00	0.00	0.00	0.00
26.50	0.00	0.00	0.00
27.00	0.00	0.00	0.00
27.50	0.00	0.00	0.00
28.00	0.00	0.00	0.00
28.50	0.00	0.00	0.00
29.00	0.00	0.00	0.00
29.50	0.00	0.00	0.00
30.00	0.00	0.00	0.00
30.50	0.00	0.00	0.00
31.00	0.00	0.00	0.00
31.50	0.00	0.00	0.00
32.00	0.00	0.00	0.00
32.50	0.00	0.00	0.00
33.00	0.00	0.00	0.00
33.50	0.00	0.00	0.00
34.00	0.00	0.00	0.00
34.50	0.00	0.00	0.00
35.00	0.00	0.00	0.00
35.50	0.00	0.00	0.00
36.00	0.00	0.00	0.00
36.50	0.00	0.00	0.00
37.00	0.00	0.00	0.00
37.50	0.00	0.00	0.00
38.00	0.00	0.00	0.00
38.50	0.00	0.00	0.00
39.00	0.00	0.00	0.00
39.50	0.00	0.00	0.00
40.00	0.00	0.00	0.00
40.50	0.00	0.00	0.00
41.00	0.00	0.00	0.00
41.50	0.00	0.00	0.00
42.00	0.00	0.00	0.00
42.50	0.00	0.00	0.00
43.00	0.00	0.00	0.00
43.50	0.00	0.00	0.00
44.00	0.00	0.00	0.00
44.50	0.00	0.00	0.00
45.00	0.00	0.00	0.00
45.50	0.00	0.00	0.00
46.00	0.00	0.00	0.00
46.50	0.00	0.00	0.00
47.00	0.00	0.00	0.00
47.50	0.00	0.00	0.00
48.00	0.00	0.00	0.00

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Underground Runoff Area=9,317 sf 100.00% Impervious Runoff Depth=7.46"
Tc=5.0 min CN=98 Runoff=2.43 cfs 0.133 af

Pond 1P: Underground Infiltration Trench Peak Elev=106.47' Storage=2,058 cf Inflow=2.43 cfs 0.133 af
Outflow=0.63 cfs 0.133 af

Link 1L: Total Inflow=0.63 cfs 0.133 af
Primary=0.63 cfs 0.133 af

Total Runoff Area = 0.214 ac Runoff Volume = 0.133 af Average Runoff Depth = 7.46"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.214 ac

Summary for Subcatchment 1S: Underground Infiltration Trench

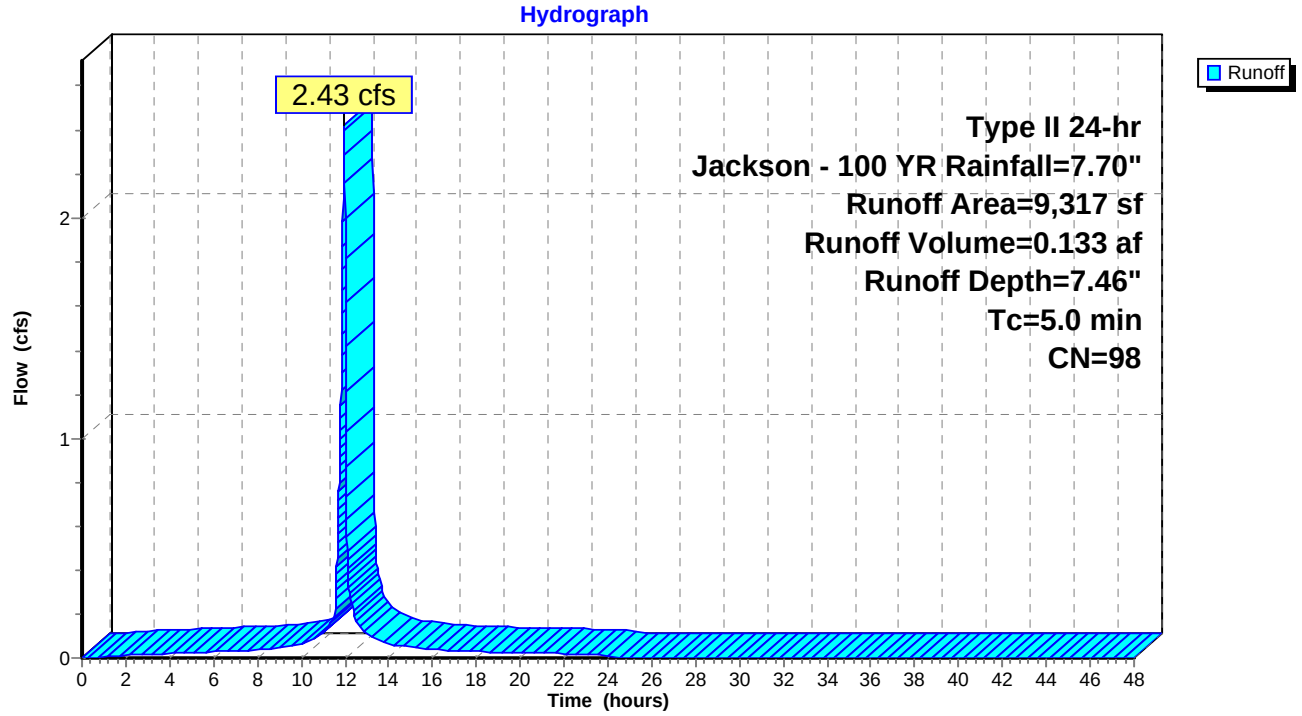
Runoff = 2.43 cfs @ 11.96 hrs, Volume= 0.133 af, Depth= 7.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr Jackson - 100 YR Rainfall=7.70"

Area (sf)	CN	Description
9,317	98	Paved parking, HSG D
9,317		100.00% Impervious Area

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

Subcatchment 1S: Underground Infiltration Trench



Hydrograph for Subcatchment 1S: Underground Infiltration Trench

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.04	0.00	0.00
1.00	0.08	0.01	0.00
1.50	0.12	0.02	0.01
2.00	0.17	0.05	0.01
2.50	0.22	0.08	0.01
3.00	0.27	0.12	0.02
3.50	0.32	0.16	0.02
4.00	0.37	0.20	0.02
4.50	0.43	0.25	0.02
5.00	0.49	0.30	0.02
5.50	0.55	0.36	0.03
6.00	0.62	0.42	0.03
6.50	0.69	0.49	0.03
7.00	0.76	0.56	0.03
7.50	0.84	0.64	0.03
8.00	0.92	0.72	0.03
8.50	1.02	0.81	0.04
9.00	1.13	0.92	0.05
9.50	1.26	1.04	0.05
10.00	1.39	1.18	0.06
10.50	1.57	1.35	0.08
11.00	1.81	1.59	0.11
11.50	2.18	1.95	**0.19**
12.00	5.11	4.87	**2.00**
12.50	5.66	5.42	0.17
13.00	5.94	5.71	0.11
13.50	6.15	5.91	0.08
14.00	6.31	6.08	0.06
14.50	6.45	6.21	0.06
15.00	6.57	6.33	0.05
15.50	6.68	6.44	0.04
16.00	6.78	6.54	0.04
16.50	6.86	6.62	0.04
17.00	6.94	6.70	0.03
17.50	7.02	6.78	0.03
18.00	7.09	6.85	0.03
18.50	7.16	6.92	0.03
19.00	7.22	6.98	0.03
19.50	7.28	7.04	0.02
20.00	7.33	7.09	0.02
20.50	7.38	7.14	0.02
21.00	7.43	7.19	0.02
21.50	7.48	7.24	0.02
22.00	7.52	7.28	0.02
22.50	7.57	7.33	0.02
23.00	7.61	7.37	0.02
23.50	7.66	7.42	0.02
24.00	**7.70**	**7.46**	0.02
24.50	7.70	7.46	0.00
25.00	7.70	7.46	0.00
25.50	7.70	7.46	0.00
26.00	7.70	7.46	0.00
26.50	7.70	7.46	0.00
27.00	7.70	7.46	0.00
27.50	7.70	7.46	0.00
28.00	7.70	7.46	0.00
28.50	7.70	7.46	0.00
29.00	7.70	7.46	0.00
29.50	7.70	7.46	0.00
30.00	7.70	7.46	0.00
30.50	7.70	7.46	0.00
31.00	7.70	7.46	0.00
31.50	7.70	7.46	0.00
32.00	7.70	7.46	0.00
32.50	7.70	7.46	0.00
33.00	7.70	7.46	0.00
33.50	7.70	7.46	0.00
34.00	7.70	7.46	0.00
34.50	7.70	7.46	0.00
35.00	7.70	7.46	0.00
35.50	7.70	7.46	0.00
36.00	7.70	7.46	0.00
36.50	7.70	7.46	0.00
37.00	7.70	7.46	0.00
37.50	7.70	7.46	0.00
38.00	7.70	7.46	0.00
38.50	7.70	7.46	0.00
39.00	7.70	7.46	0.00
39.50	7.70	7.46	0.00
40.00	7.70	7.46	0.00
40.50	7.70	7.46	0.00
41.00	7.70	7.46	0.00
41.50	7.70	7.46	0.00
42.00	7.70	7.46	0.00
42.50	7.70	7.46	0.00
43.00	7.70	7.46	0.00
43.50	7.70	7.46	0.00
44.00	7.70	7.46	0.00
44.50	7.70	7.46	0.00
45.00	7.70	7.46	0.00
45.50	7.70	7.46	0.00
46.00	7.70	7.46	0.00
46.50	7.70	7.46	0.00
47.00	7.70	7.46	0.00
47.50	7.70	7.46	0.00
48.00	7.70	7.46	0.00

Summary for Pond 1P: Underground Infiltration Trench

Inflow Area = 0.214 ac,100.00% Impervious, Inflow Depth = 7.46" for Jackson - 100 YR event
Inflow = 2.43 cfs @ 11.96 hrs, Volume= 0.133 af
Outflow = 0.63 cfs @ 12.08 hrs, Volume= 0.133 af, Atten= 74%, Lag= 7.5 min
Primary = 0.63 cfs @ 12.08 hrs, Volume= 0.133 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 106.47' @ 12.08 hrs Surf.Area= 556 sf Storage= 2,058 cf

Plug-Flow detention time= 66.5 min calculated for 0.133 af (100% of inflow)
Center-of-Mass det. time= 66.5 min (803.1 - 736.5)

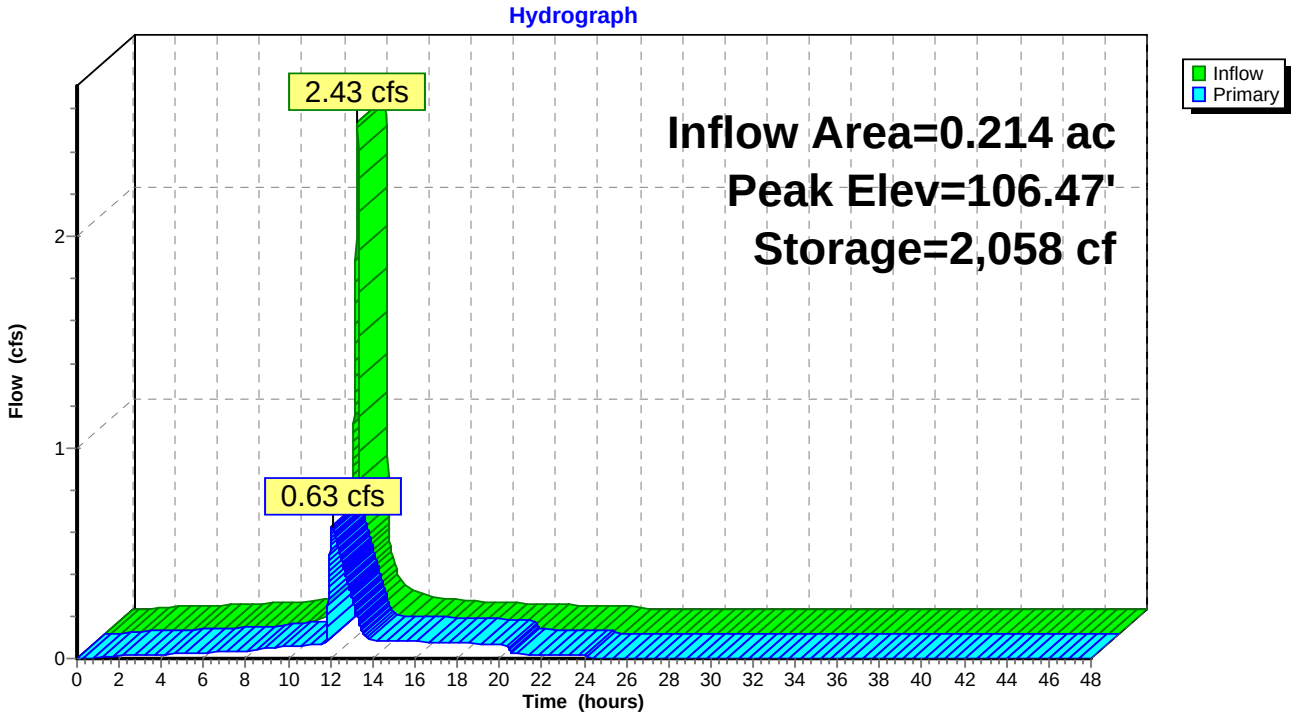
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,091 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 3,759 cf Overall - 1,031 cf Embedded = 2,728 cf x 40.0% Voids
#2	100.75'	1,031 cf	**ADS_StormTech MC-4500 +Cap @ 4.03' L** x 9 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.6 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
		2,122 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	556	0	0
106.76	556	3,759	3,759

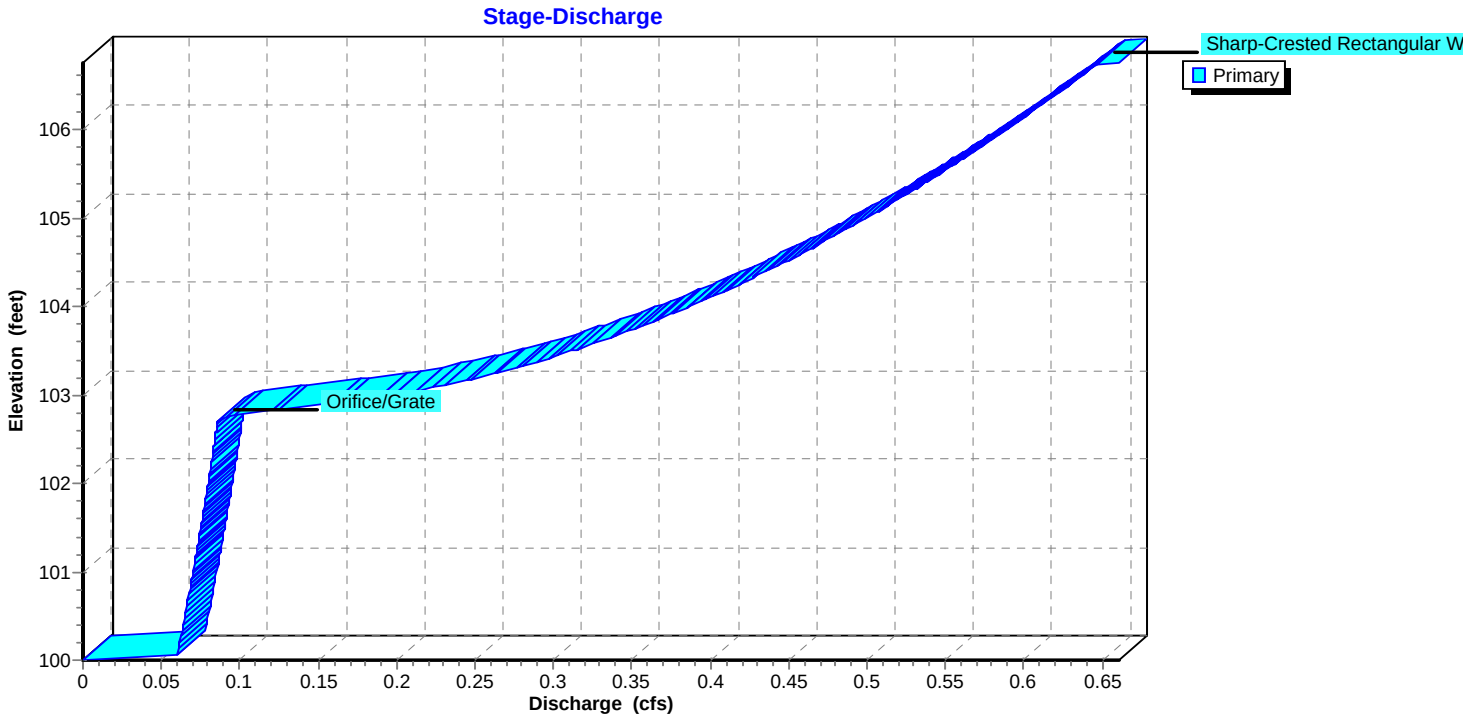
Device	Routing	Invert	Outlet Devices
#1	Primary	97.00'	**15.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 97.00' / 96.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	106.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	97.50'	**1.2" Vert. Orifice/Grate** C= 0.600
#4	Device 1	102.70'	**3.2" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.63 cfs @ 12.08 hrs HW=106.47' (Free Discharge)
└**1=Culvert** (Passes 0.63 cfs of 15.28 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 0.11 cfs @ 14.38 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.51 cfs @ 9.19 fps)

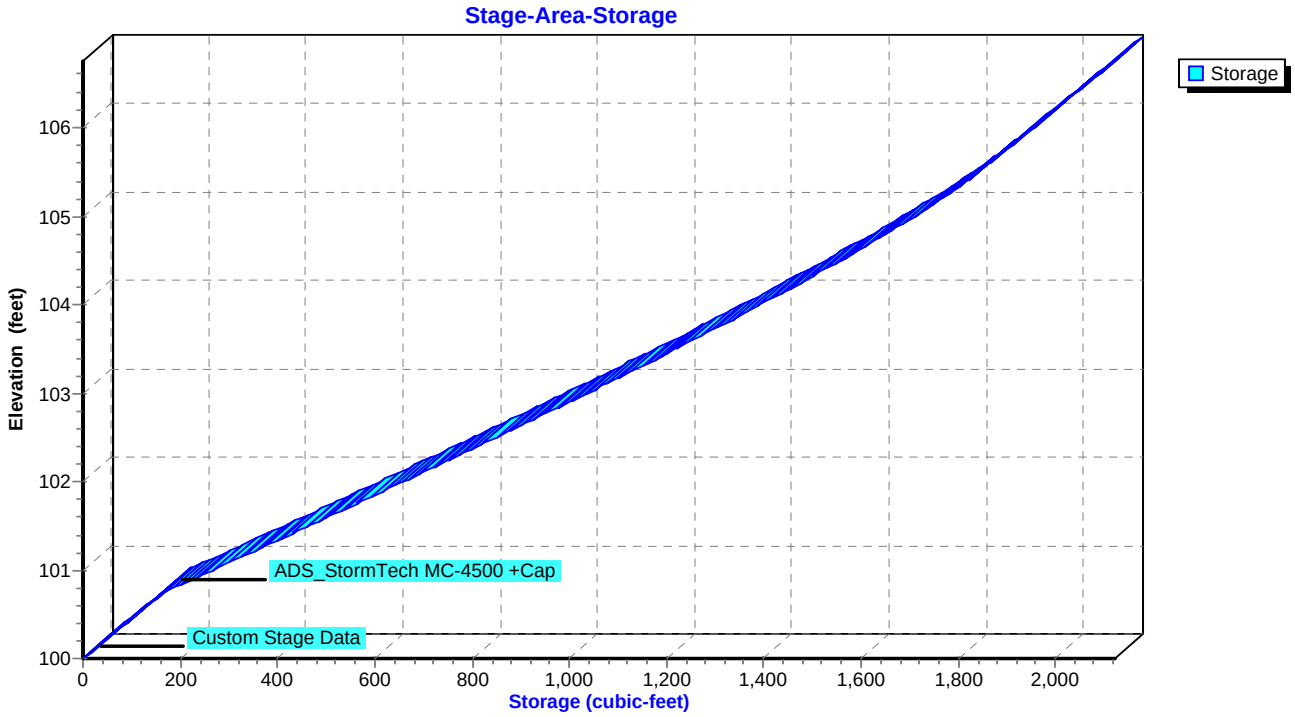
Pond 1P: Underground Infiltration Trench



Pond 1P: Underground Infiltration Trench



Pond 1P: Underground Infiltration Trench



Hydrograph for Pond 1P: Underground Infiltration Trench

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	100.00	0.00
1.00	0.00	1	100.00	0.00
2.00	0.01	3	100.01	0.01
3.00	0.02	4	100.02	0.02
4.00	0.02	5	100.02	0.02
5.00	0.02	6	100.03	0.02
6.00	0.03	7	100.03	0.03
7.00	0.03	8	100.03	0.03
8.00	0.03	9	100.04	0.03
9.00	0.05	12	100.06	0.05
10.00	0.06	16	100.07	0.06
11.00	**0.11**	98	100.44	0.06
12.00	**2.00**	**1,872**	**105.64**	**0.56**
13.00	0.11	**1,184**	**103.41**	**0.29**
14.00	0.06	929	102.71	0.09
15.00	0.05	827	102.44	0.08
16.00	0.04	693	102.09	0.08
17.00	0.03	540	101.70	0.08
18.00	0.03	386	101.30	0.07
19.00	0.03	231	100.91	0.07
20.00	0.02	77	100.35	0.06
21.00	0.02	5	100.02	0.02
22.00	0.02	5	100.02	0.02
23.00	0.02	5	100.02	0.02
24.00	0.02	5	100.02	0.02
25.00	0.00	0	100.00	0.00
26.00	0.00	0	100.00	0.00
27.00	0.00	0	100.00	0.00
28.00	0.00	0	100.00	0.00
29.00	0.00	0	100.00	0.00
30.00	0.00	0	100.00	0.00
31.00	0.00	0	100.00	0.00
32.00	0.00	0	100.00	0.00
33.00	0.00	0	100.00	0.00
34.00	0.00	0	100.00	0.00
35.00	0.00	0	100.00	0.00
36.00	0.00	0	100.00	0.00
37.00	0.00	0	100.00	0.00
38.00	0.00	0	100.00	0.00
39.00	0.00	0	100.00	0.00
40.00	0.00	0	100.00	0.00
41.00	0.00	0	100.00	0.00
42.00	0.00	0	100.00	0.00
43.00	0.00	0	100.00	0.00
44.00	0.00	0	100.00	0.00
45.00	0.00	0	100.00	0.00
46.00	0.00	0	100.00	0.00
47.00	0.00	0	100.00	0.00
48.00	0.00	0	100.00	0.00

Stage-Discharge for Pond 1P: Underground Infiltration Trench

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
100.00	0.00	102.12	0.08	104.24	0.42	106.36	0.62
100.04	0.06	102.16	0.08	104.28	0.42	106.40	0.62
100.08	0.06	102.20	0.08	104.32	0.43	106.44	0.62
100.12	0.06	102.24	0.08	104.36	0.43	106.48	0.63
100.16	0.06	102.28	0.08	104.40	0.44	106.52	0.63
100.20	0.06	102.32	0.08	104.44	0.44	106.56	0.63
100.24	0.06	102.36	0.08	104.48	0.44	106.60	0.64
100.28	0.06	102.40	0.08	104.52	0.45	106.64	0.64
100.32	0.06	102.44	0.08	104.56	0.45	106.68	0.64
100.36	0.06	102.48	0.08	104.60	0.46	106.72	0.64
100.40	0.06	102.52	0.08	104.64	0.46	106.76	**0.66**
100.44	0.06	102.56	0.08	104.68	0.47		
100.48	0.06	102.60	0.08	104.72	0.47		
100.52	0.07	102.64	0.09	104.76	0.47		
100.56	0.07	102.68	0.09	104.80	0.48		
100.60	0.07	102.72	0.09	104.84	0.48		
100.64	0.07	102.76	0.09	104.88	0.49		
100.68	0.07	102.80	0.11	104.92	0.49		
100.72	0.07	102.84	0.12	104.96	0.50		
100.76	0.07	102.88	0.15	105.00	0.50		
100.80	0.07	102.92	0.17	105.04	0.50		
100.84	0.07	102.96	0.18	105.08	0.51		
100.88	0.07	103.00	0.20	105.12	0.51		
100.92	0.07	103.04	0.21	105.16	0.51		
100.96	0.07	103.08	0.22	105.20	0.52		
101.00	0.07	103.12	0.23	105.24	0.52		
101.04	0.07	103.16	0.24	105.28	0.53		
101.08	0.07	103.20	0.25	105.32	0.53		
101.12	0.07	103.24	0.26	105.36	0.53		
101.16	0.07	103.28	0.27	105.40	0.54		
101.20	0.07	103.32	0.28	105.44	0.54		
101.24	0.07	103.36	0.29	105.48	0.54		
101.28	0.07	103.40	0.29	105.52	0.55		
101.32	0.07	103.44	0.30	105.56	0.55		
101.36	0.07	103.48	0.31	105.60	0.55		
101.40	0.07	103.52	0.32	105.64	0.56		
101.44	0.07	103.56	0.32	105.68	0.56		
101.48	0.07	103.60	0.33	105.72	0.56		
101.52	0.08	103.64	0.33	105.76	0.57		
101.56	0.08	103.68	0.34	105.80	0.57		
101.60	0.08	103.72	0.35	105.84	0.58		
101.64	0.08	103.76	0.35	105.88	0.58		
101.68	0.08	103.80	0.36	105.92	0.58		
101.72	0.08	103.84	0.36	105.96	0.59		
101.76	0.08	103.88	0.37	106.00	0.59		
101.80	0.08	103.92	0.38	106.04	0.59		
101.84	0.08	103.96	0.38	106.08	0.60		
101.88	0.08	104.00	0.39	106.12	0.60		
101.92	0.08	104.04	0.39	106.16	0.60		
101.96	0.08	104.08	0.40	106.20	0.60		
102.00	0.08	104.12	0.40	106.24	0.61		
102.04	0.08	104.16	0.41	106.28	0.61		
102.08	0.08	104.20	0.41	106.32	0.61		

Stage-Area-Storage for Pond 1P: Underground Infiltration Trench

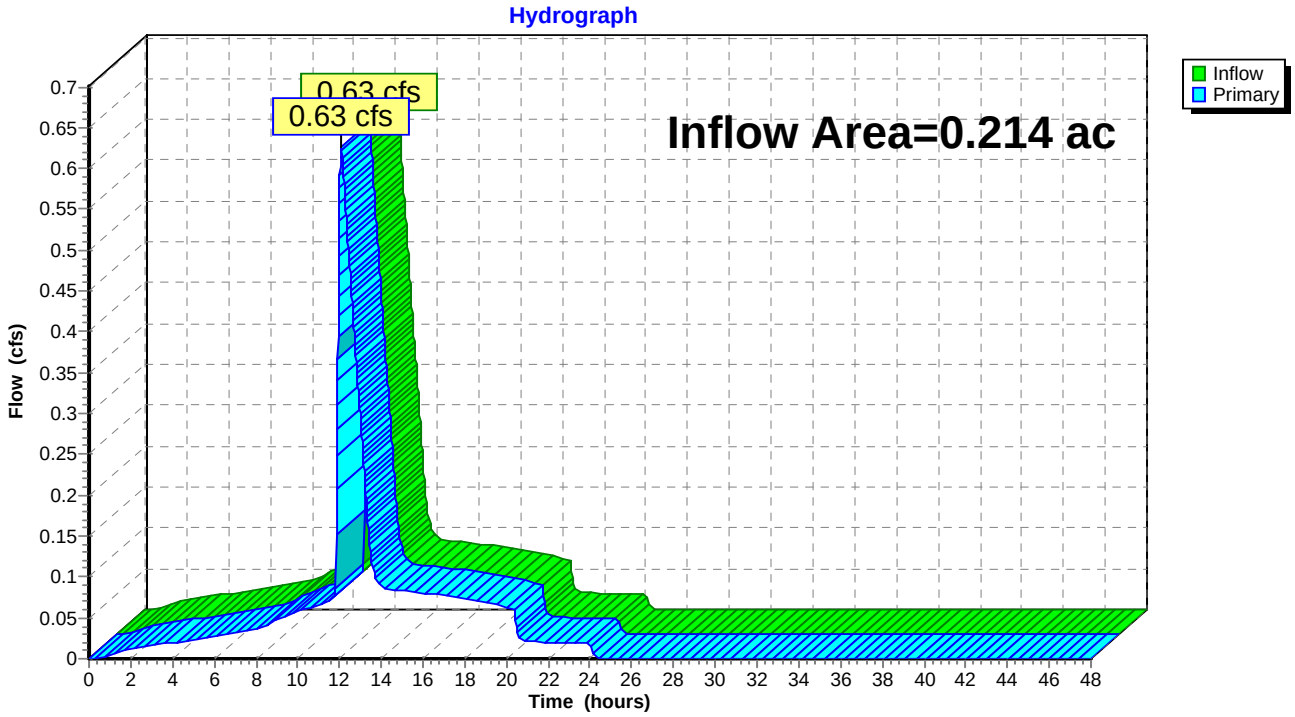
Elevation (feet)	Storage (cubic-feet)
100.00	0
100.10	22
100.20	44
100.30	67
100.40	89
100.50	111
100.60	133
100.70	156
100.80	187
100.90	227
101.00	266
101.10	306
101.20	345
101.30	385
101.40	424
101.50	464
101.60	503
101.70	542
101.80	581
101.90	620
102.00	658
102.10	697
102.20	735
102.30	774
102.40	812
102.50	850
102.60	887
102.70	925
102.80	962
102.90	999
103.00	1,036
103.10	1,073
103.20	1,110
103.30	1,146
103.40	1,182
103.50	1,218
103.60	1,253
103.70	1,288
103.80	1,323
103.90	1,358
104.00	1,392
104.10	1,426
104.20	1,459
104.30	1,492
104.40	1,525
104.50	1,557
104.60	1,589
104.70	1,620
104.80	1,650
104.90	1,680
105.00	1,710
105.10	1,738
105.20	1,765
105.30	1,792
105.40	1,816
105.50	1,840
105.60	1,863
105.70	1,886
105.80	1,909
105.90	1,931
106.00	1,953
106.10	1,975
106.20	1,997
106.30	2,020
106.40	2,042
106.50	2,064
106.60	2,086
106.70	**2,109**

Summary for Link 1L: Total

Inflow Area = 0.214 ac,100.00% Impervious, Inflow Depth = 7.46" for Jackson - 100 YR event
Inflow = 0.63 cfs @ 12.08 hrs, Volume= 0.133 af
Primary = 0.63 cfs @ 12.08 hrs, Volume= 0.133 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: Total



Hydrograph for Link 1L: Total

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
0.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00
1.50	0.01	0.00	0.01
2.00	0.01	0.00	0.01
2.50	0.01	0.00	0.01
3.00	0.02	0.00	0.02
3.50	0.02	0.00	0.02
4.00	0.02	0.00	0.02
4.50	0.02	0.00	0.02
5.00	0.02	0.00	0.02
5.50	0.03	0.00	0.03
6.00	0.03	0.00	0.03
6.50	0.03	0.00	0.03
7.00	0.03	0.00	0.03
7.50	0.03	0.00	0.03
8.00	0.03	0.00	0.03
8.50	0.04	0.00	0.04
9.00	0.05	0.00	0.05
9.50	0.05	0.00	0.05
10.00	0.06	0.00	0.06
10.50	0.06	0.00	0.06
11.00	0.06	0.00	0.06
11.50	0.07	0.00	0.07
12.00	**0.56**	0.00	**0.56**
12.50	**0.47**	0.00	**0.47**
13.00	0.29	0.00	0.29
13.50	0.13	0.00	0.13
14.00	0.09	0.00	0.09
14.50	0.08	0.00	0.08
15.00	0.08	0.00	0.08
15.50	0.08	0.00	0.08
16.00	0.08	0.00	0.08
16.50	0.08	0.00	0.08
17.00	0.08	0.00	0.08
17.50	0.08	0.00	0.08
18.00	0.07	0.00	0.07
18.50	0.07	0.00	0.07
19.00	0.07	0.00	0.07
19.50	0.07	0.00	0.07
20.00	0.06	0.00	0.06
20.50	0.03	0.00	0.03
21.00	0.02	0.00	0.02
21.50	0.02	0.00	0.02
22.00	0.02	0.00	0.02
22.50	0.02	0.00	0.02
23.00	0.02	0.00	0.02
23.50	0.02	0.00	0.02
24.00	0.02	0.00	0.02
24.50	0.00	0.00	0.00
25.00	0.00	0.00	0.00
25.50	0.00	0.00	0.00
26.00	0.00	0.00	0.00
26.50	0.00	0.00	0.00
27.00	0.00	0.00	0.00
27.50	0.00	0.00	0.00
28.00	0.00	0.00	0.00
28.50	0.00	0.00	0.00
29.00	0.00	0.00	0.00
29.50	0.00	0.00	0.00
30.00	0.00	0.00	0.00
30.50	0.00	0.00	0.00
31.00	0.00	0.00	0.00
31.50	0.00	0.00	0.00
32.00	0.00	0.00	0.00
32.50	0.00	0.00	0.00
33.00	0.00	0.00	0.00
33.50	0.00	0.00	0.00
34.00	0.00	0.00	0.00
34.50	0.00	0.00	0.00
35.00	0.00	0.00	0.00
35.50	0.00	0.00	0.00
36.00	0.00	0.00	0.00
36.50	0.00	0.00	0.00
37.00	0.00	0.00	0.00
37.50	0.00	0.00	0.00
38.00	0.00	0.00	0.00
38.50	0.00	0.00	0.00
39.00	0.00	0.00	0.00
39.50	0.00	0.00	0.00
40.00	0.00	0.00	0.00
40.50	0.00	0.00	0.00
41.00	0.00	0.00	0.00
41.50	0.00	0.00	0.00
42.00	0.00	0.00	0.00
42.50	0.00	0.00	0.00
43.00	0.00	0.00	0.00
43.50	0.00	0.00	0.00
44.00	0.00	0.00	0.00
44.50	0.00	0.00	0.00
45.00	0.00	0.00	0.00
45.50	0.00	0.00	0.00
46.00	0.00	0.00	0.00
46.50	0.00	0.00	0.00
47.00	0.00	0.00	0.00
47.50	0.00	0.00	0.00
48.00	0.00	0.00	0.00

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Underground Runoff Area=9,317 sf 100.00% Impervious Runoff Depth=3.27"
Tc=5.0 min CN=98 Runoff=1.09 cfs 0.058 af

Pond 1P: Underground Infiltration Trench Peak Elev=102.78' Storage=955 cf Inflow=1.09 cfs 0.058 af
Outflow=0.10 cfs 0.058 af

Link 1L: Total Inflow=0.10 cfs 0.058 af
Primary=0.10 cfs 0.058 af

Total Runoff Area = 0.214 ac Runoff Volume = 0.058 af Average Runoff Depth = 3.27"
0.00% Pervious = 0.000 ac 100.00% Impervious = 0.214 ac

Summary for Subcatchment 1S: Underground Infiltration Trench

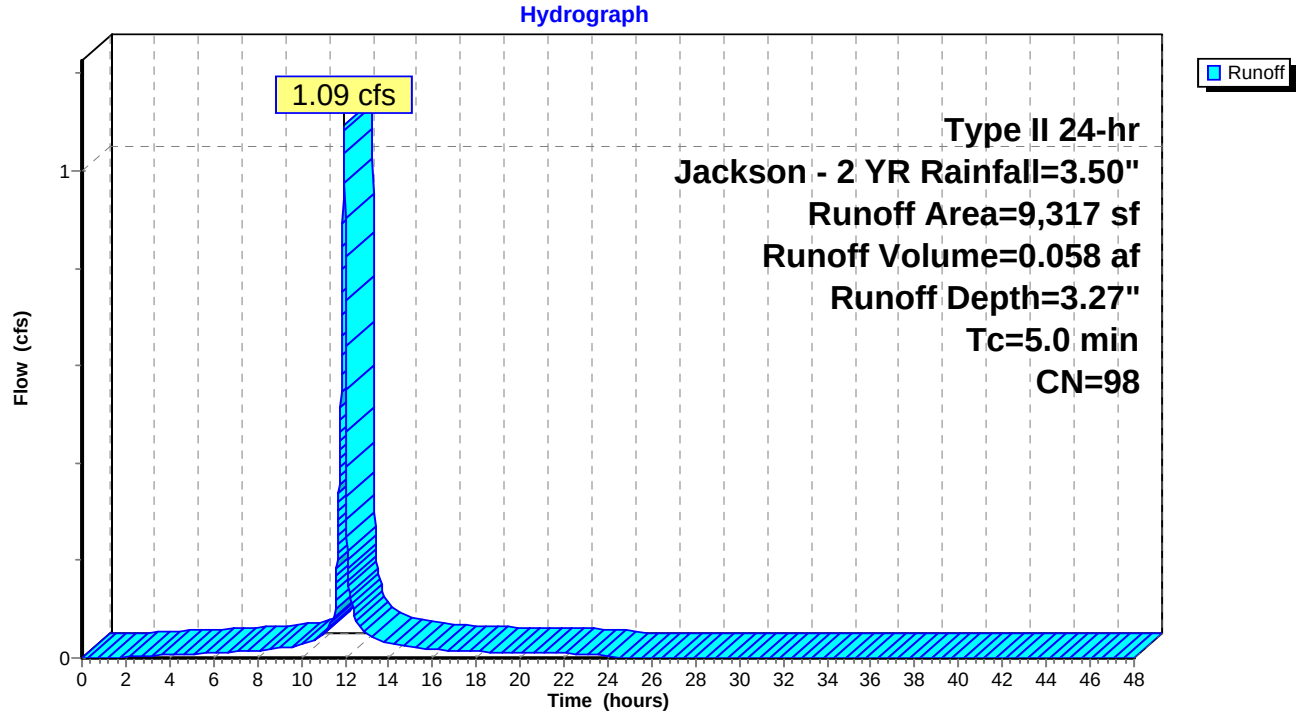
Runoff = 1.09 cfs @ 11.96 hrs, Volume= 0.058 af, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr Jackson - 2 YR Rainfall=3.50"

Area (sf)	CN	Description
9,317	98	Paved parking, HSG D
9,317		100.00% Impervious Area

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

Subcatchment 1S: Underground Infiltration Trench



Hydrograph for Subcatchment 1S: Underground Infiltration Trench

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
0.50	0.02	0.00	0.00
1.00	0.04	0.00	0.00
1.50	0.06	0.00	0.00
2.00	0.08	0.01	0.00
2.50	0.10	0.01	0.00
3.00	0.12	0.02	0.00
3.50	0.14	0.03	0.01
4.00	0.17	0.05	0.01
4.50	0.19	0.07	0.01
5.00	0.22	0.08	0.01
5.50	0.25	0.11	0.01
6.00	0.28	0.13	0.01
6.50	0.31	0.16	0.01
7.00	0.35	0.18	0.01
7.50	0.38	0.21	0.01
8.00	0.42	0.25	0.01
8.50	0.46	0.28	0.02
9.00	0.51	0.33	0.02
9.50	0.57	0.38	0.02
10.00	0.63	0.44	0.03
10.50	0.71	0.52	0.04
11.00	0.82	0.62	0.05
11.50	0.99	0.78	**0.08**
12.00	2.32	2.09	**0.90**
12.50	2.57	2.34	0.08
13.00	2.70	2.47	0.05
13.50	2.80	2.57	0.04
14.00	2.87	2.64	0.03
14.50	2.93	2.70	0.03
15.00	2.99	2.76	0.02
15.50	3.04	2.80	0.02
16.00	3.08	2.85	0.02
16.50	3.12	2.89	0.02
17.00	3.16	2.92	0.02
17.50	3.19	2.96	0.01
18.00	3.22	2.99	0.01
18.50	3.25	3.02	0.01
19.00	3.28	3.05	0.01
19.50	3.31	3.08	0.01
20.00	3.33	3.10	0.01
20.50	3.35	3.12	0.01
21.00	3.38	3.14	0.01
21.50	3.40	3.17	0.01
22.00	3.42	3.19	0.01
22.50	3.44	3.21	0.01
23.00	3.46	3.23	0.01
23.50	3.48	3.25	0.01
24.00	**3.50**	**3.27**	0.01
24.50	3.50	3.27	0.00
25.00	3.50	3.27	0.00
25.50	3.50	3.27	0.00
26.00	3.50	3.27	0.00
26.50	3.50	3.27	0.00
27.00	3.50	3.27	0.00
27.50	3.50	3.27	0.00
28.00	3.50	3.27	0.00
28.50	3.50	3.27	0.00
29.00	3.50	3.27	0.00
29.50	3.50	3.27	0.00
30.00	3.50	3.27	0.00
30.50	3.50	3.27	0.00
31.00	3.50	3.27	0.00
31.50	3.50	3.27	0.00
32.00	3.50	3.27	0.00
32.50	3.50	3.27	0.00
33.00	3.50	3.27	0.00
33.50	3.50	3.27	0.00
34.00	3.50	3.27	0.00
34.50	3.50	3.27	0.00
35.00	3.50	3.27	0.00
35.50	3.50	3.27	0.00
36.00	3.50	3.27	0.00
36.50	3.50	3.27	0.00
37.00	3.50	3.27	0.00
37.50	3.50	3.27	0.00
38.00	3.50	3.27	0.00
38.50	3.50	3.27	0.00
39.00	3.50	3.27	0.00
39.50	3.50	3.27	0.00
40.00	3.50	3.27	0.00
40.50	3.50	3.27	0.00
41.00	3.50	3.27	0.00
41.50	3.50	3.27	0.00
42.00	3.50	3.27	0.00
42.50	3.50	3.27	0.00
43.00	3.50	3.27	0.00
43.50	3.50	3.27	0.00
44.00	3.50	3.27	0.00
44.50	3.50	3.27	0.00
45.00	3.50	3.27	0.00
45.50	3.50	3.27	0.00
46.00	3.50	3.27	0.00
46.50	3.50	3.27	0.00
47.00	3.50	3.27	0.00
47.50	3.50	3.27	0.00
48.00	3.50	3.27	0.00

Summary for Pond 1P: Underground Infiltration Trench

Inflow Area = 0.214 ac,100.00% Impervious, Inflow Depth = 3.27" for Jackson - 2 YR event
Inflow = 1.09 cfs @ 11.96 hrs, Volume= 0.058 af
Outflow = 0.10 cfs @ 12.37 hrs, Volume= 0.058 af, Atten= 91%, Lag= 24.7 min
Primary = 0.10 cfs @ 12.37 hrs, Volume= 0.058 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 102.78' @ 12.37 hrs Surf.Area= 556 sf Storage= 955 cf

Plug-Flow detention time= 78.4 min calculated for 0.058 af (100% of inflow)
Center-of-Mass det. time= 78.4 min (828.1 - 749.7)

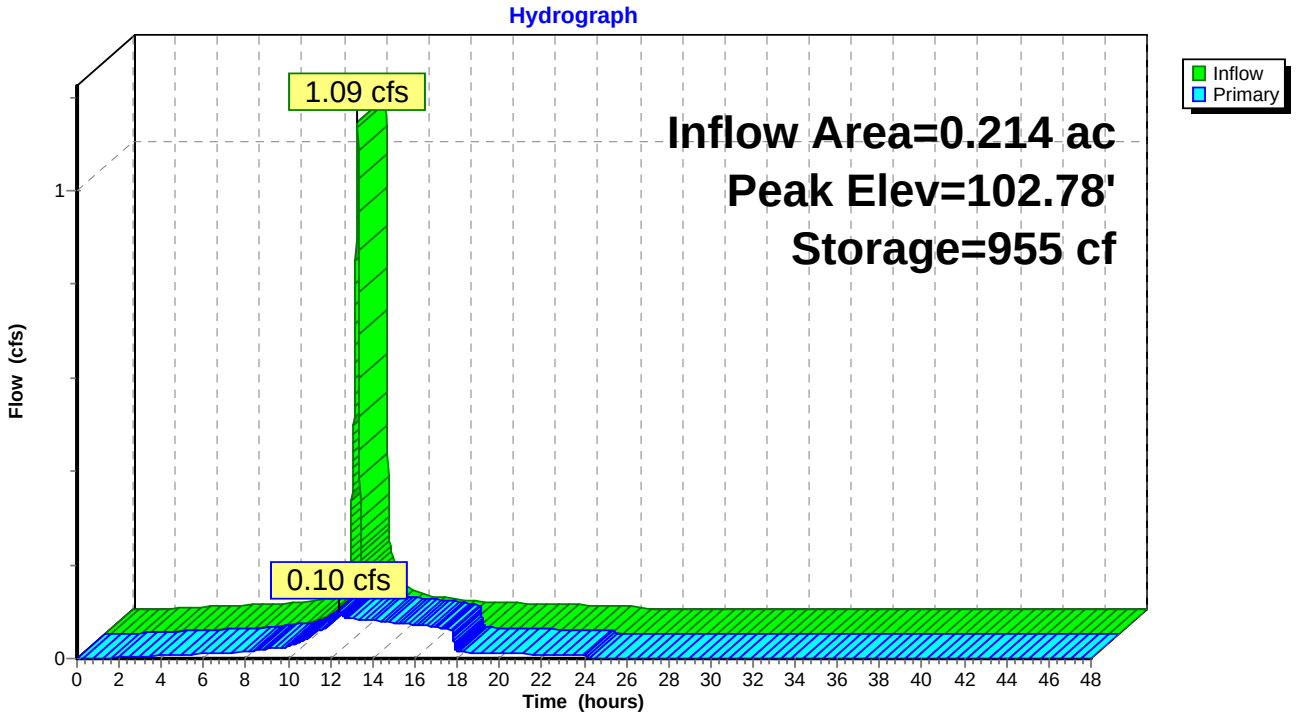
Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	1,091 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 3,759 cf Overall - 1,031 cf Embedded = 2,728 cf x 40.0% Voids
#2	100.75'	1,031 cf	**ADS_StormTech MC-4500 +Cap @ 4.03' L** x 9 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.6 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap Cap Storage= +35.7 cf x 2 x 1 rows = 71.4 cf
		2,122 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
100.00	556	0	0
106.76	556	3,759	3,759

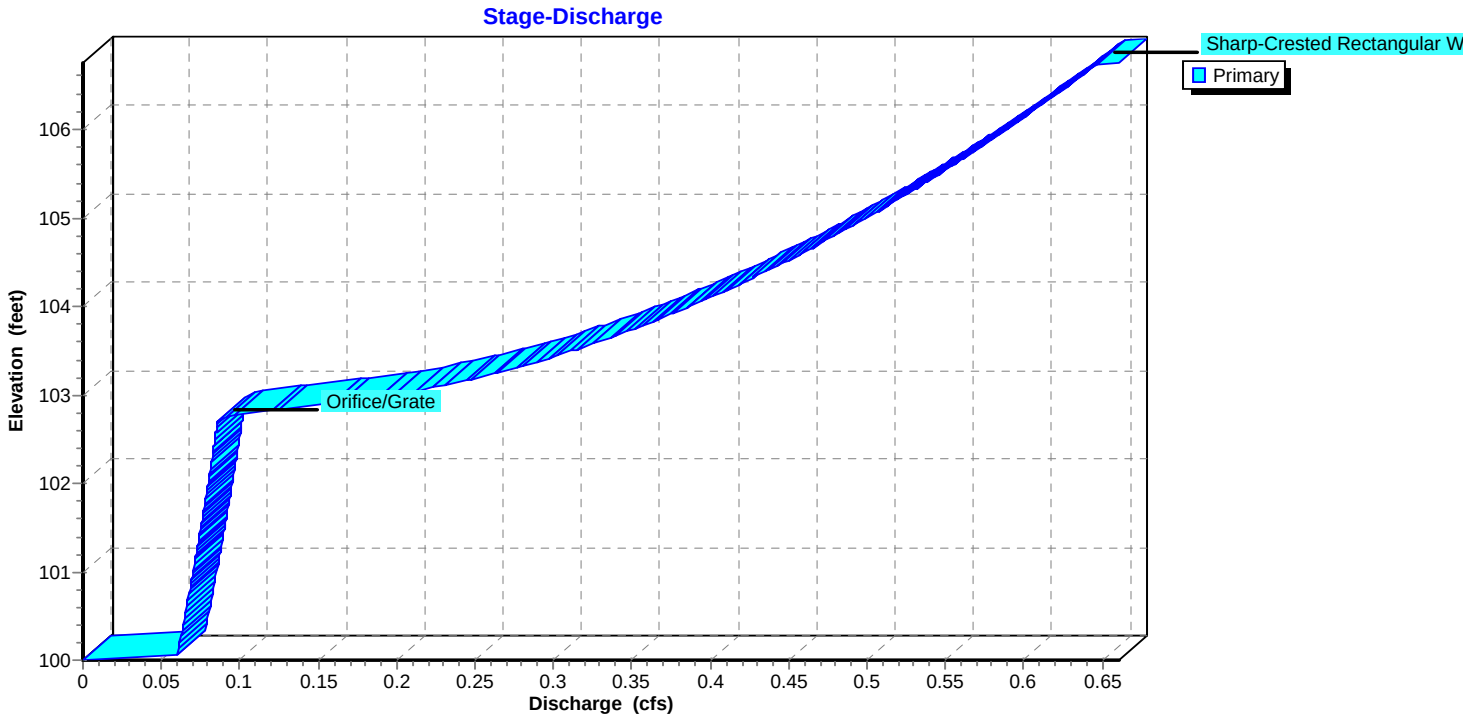
Device	Routing	Invert	Outlet Devices
#1	Primary	97.00'	**15.0" Round Culvert** L= 100.0' RCP, sq.cut end projecting, Ke= 0.500 Inlet / Outlet Invert= 97.00' / 96.00' S= 0.0100 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#2	Device 1	106.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	97.50'	**1.2" Vert. Orifice/Grate** C= 0.600
#4	Device 1	102.70'	**3.2" Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.10 cfs @ 12.37 hrs HW=102.78' (Free Discharge)
└**1=Culvert** (Passes 0.10 cfs of 11.83 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**3=Orifice/Grate** (Orifice Controls 0.09 cfs @ 11.01 fps)
  └**4=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.97 fps)

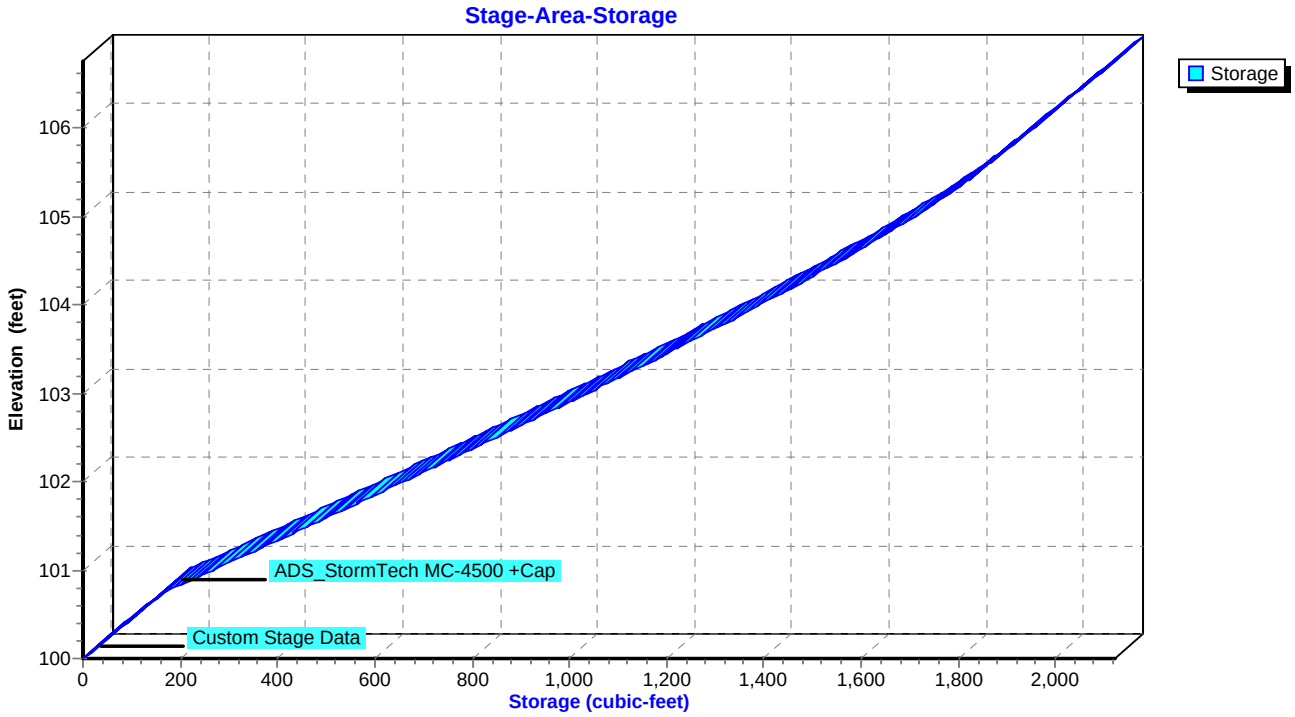
Pond 1P: Underground Infiltration Trench



Pond 1P: Underground Infiltration Trench



Pond 1P: Underground Infiltration Trench



Hydrograph for Pond 1P: Underground Infiltration Trench

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	100.00	0.00
1.00	0.00	0	100.00	0.00
2.00	0.00	1	100.00	0.00
3.00	0.00	1	100.01	0.00
4.00	0.01	2	100.01	0.01
5.00	0.01	2	100.01	0.01
6.00	0.01	3	100.01	0.01
7.00	0.01	3	100.01	0.01
8.00	0.01	4	100.02	0.01
9.00	0.02	5	100.02	0.02
10.00	0.03	7	100.03	0.03
11.00	**0.05**	12	100.05	0.05
12.00	**0.90**	**768**	**102.28**	**0.08**
13.00	0.05	**899**	**102.63**	**0.09**
14.00	0.03	734	102.20	0.08
15.00	0.02	540	101.70	0.08
16.00	0.02	345	101.20	0.07
17.00	0.02	153	100.69	0.07
18.00	0.01	4	100.02	0.02
19.00	0.01	3	100.01	0.01
20.00	0.01	3	100.01	0.01
21.00	0.01	2	100.01	0.01
22.00	0.01	2	100.01	0.01
23.00	0.01	2	100.01	0.01
24.00	0.01	2	100.01	0.01
25.00	0.00	0	100.00	0.00
26.00	0.00	0	100.00	0.00
27.00	0.00	0	100.00	0.00
28.00	0.00	0	100.00	0.00
29.00	0.00	0	100.00	0.00
30.00	0.00	0	100.00	0.00
31.00	0.00	0	100.00	0.00
32.00	0.00	0	100.00	0.00
33.00	0.00	0	100.00	0.00
34.00	0.00	0	100.00	0.00
35.00	0.00	0	100.00	0.00
36.00	0.00	0	100.00	0.00
37.00	0.00	0	100.00	0.00
38.00	0.00	0	100.00	0.00
39.00	0.00	0	100.00	0.00
40.00	0.00	0	100.00	0.00
41.00	0.00	0	100.00	0.00
42.00	0.00	0	100.00	0.00
43.00	0.00	0	100.00	0.00
44.00	0.00	0	100.00	0.00
45.00	0.00	0	100.00	0.00
46.00	0.00	0	100.00	0.00
47.00	0.00	0	100.00	0.00
48.00	0.00	0	100.00	0.00

Stage-Discharge for Pond 1P: Underground Infiltration Trench

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
100.00	0.00	102.12	0.08	104.24	0.42	106.36	0.62
100.04	0.06	102.16	0.08	104.28	0.42	106.40	0.62
100.08	0.06	102.20	0.08	104.32	0.43	106.44	0.62
100.12	0.06	102.24	0.08	104.36	0.43	106.48	0.63
100.16	0.06	102.28	0.08	104.40	0.44	106.52	0.63
100.20	0.06	102.32	0.08	104.44	0.44	106.56	0.63
100.24	0.06	102.36	0.08	104.48	0.44	106.60	0.64
100.28	0.06	102.40	0.08	104.52	0.45	106.64	0.64
100.32	0.06	102.44	0.08	104.56	0.45	106.68	0.64
100.36	0.06	102.48	0.08	104.60	0.46	106.72	0.64
100.40	0.06	102.52	0.08	104.64	0.46	106.76	**0.66**
100.44	0.06	102.56	0.08	104.68	0.47		
100.48	0.06	102.60	0.08	104.72	0.47		
100.52	0.07	102.64	0.09	104.76	0.47		
100.56	0.07	102.68	0.09	104.80	0.48		
100.60	0.07	102.72	0.09	104.84	0.48		
100.64	0.07	102.76	0.09	104.88	0.49		
100.68	0.07	102.80	0.11	104.92	0.49		
100.72	0.07	102.84	0.12	104.96	0.50		
100.76	0.07	102.88	0.15	105.00	0.50		
100.80	0.07	102.92	0.17	105.04	0.50		
100.84	0.07	102.96	0.18	105.08	0.51		
100.88	0.07	103.00	0.20	105.12	0.51		
100.92	0.07	103.04	0.21	105.16	0.51		
100.96	0.07	103.08	0.22	105.20	0.52		
101.00	0.07	103.12	0.23	105.24	0.52		
101.04	0.07	103.16	0.24	105.28	0.53		
101.08	0.07	103.20	0.25	105.32	0.53		
101.12	0.07	103.24	0.26	105.36	0.53		
101.16	0.07	103.28	0.27	105.40	0.54		
101.20	0.07	103.32	0.28	105.44	0.54		
101.24	0.07	103.36	0.29	105.48	0.54		
101.28	0.07	103.40	0.29	105.52	0.55		
101.32	0.07	103.44	0.30	105.56	0.55		
101.36	0.07	103.48	0.31	105.60	0.55		
101.40	0.07	103.52	0.32	105.64	0.56		
101.44	0.07	103.56	0.32	105.68	0.56		
101.48	0.07	103.60	0.33	105.72	0.56		
101.52	0.08	103.64	0.33	105.76	0.57		
101.56	0.08	103.68	0.34	105.80	0.57		
101.60	0.08	103.72	0.35	105.84	0.58		
101.64	0.08	103.76	0.35	105.88	0.58		
101.68	0.08	103.80	0.36	105.92	0.58		
101.72	0.08	103.84	0.36	105.96	0.59		
101.76	0.08	103.88	0.37	106.00	0.59		
101.80	0.08	103.92	0.38	106.04	0.59		
101.84	0.08	103.96	0.38	106.08	0.60		
101.88	0.08	104.00	0.39	106.12	0.60		
101.92	0.08	104.04	0.39	106.16	0.60		
101.96	0.08	104.08	0.40	106.20	0.60		
102.00	0.08	104.12	0.40	106.24	0.61		
102.04	0.08	104.16	0.41	106.28	0.61		
102.08	0.08	104.20	0.41	106.32	0.61		

Stage-Area-Storage for Pond 1P: Underground Infiltration Trench

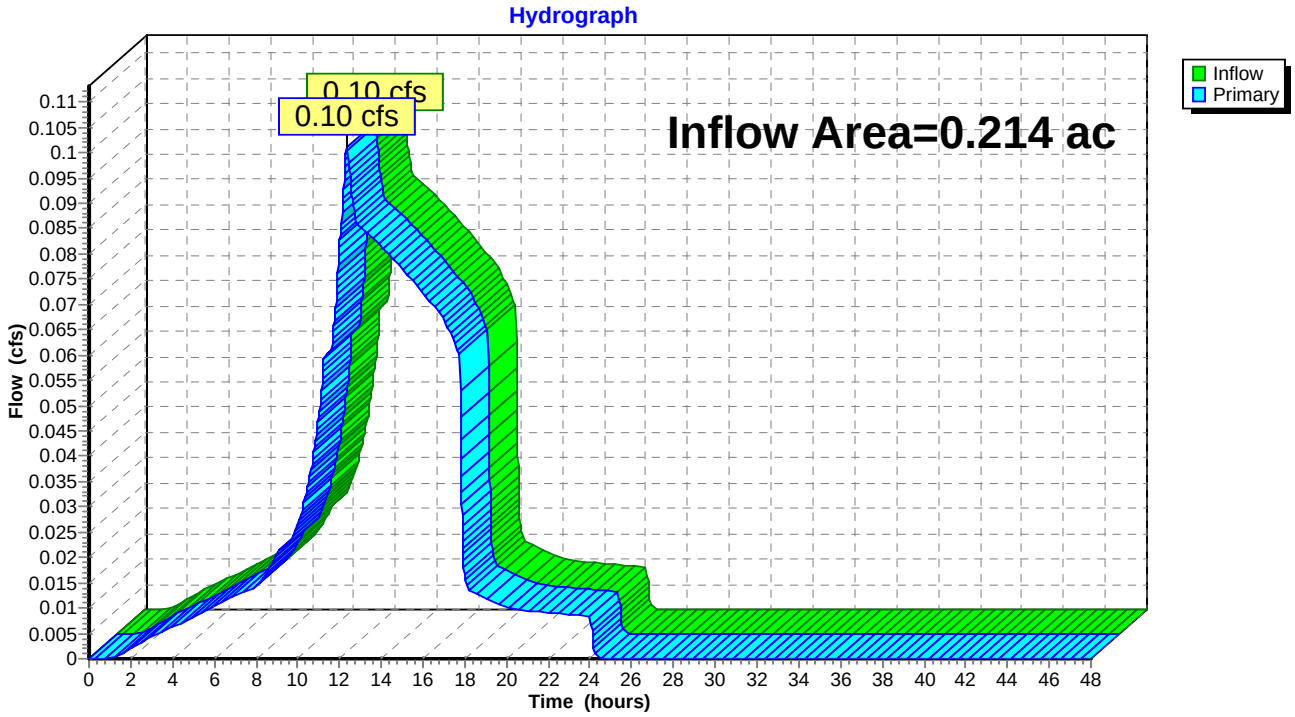
Elevation (feet)	Storage (cubic-feet)
100.00	0
100.10	22
100.20	44
100.30	67
100.40	89
100.50	111
100.60	133
100.70	156
100.80	187
100.90	227
101.00	266
101.10	306
101.20	345
101.30	385
101.40	424
101.50	464
101.60	503
101.70	542
101.80	581
101.90	620
102.00	658
102.10	697
102.20	735
102.30	774
102.40	812
102.50	850
102.60	887
102.70	925
102.80	962
102.90	999
103.00	1,036
103.10	1,073
103.20	1,110
103.30	1,146
103.40	1,182
103.50	1,218
103.60	1,253
103.70	1,288
103.80	1,323
103.90	1,358
104.00	1,392
104.10	1,426
104.20	1,459
104.30	1,492
104.40	1,525
104.50	1,557
104.60	1,589
104.70	1,620
104.80	1,650
104.90	1,680
105.00	1,710
105.10	1,738
105.20	1,765
105.30	1,792
105.40	1,816
105.50	1,840
105.60	1,863
105.70	1,886
105.80	1,909
105.90	1,931
106.00	1,953
106.10	1,975
106.20	1,997
106.30	2,020
106.40	2,042
106.50	2,064
106.60	2,086
106.70	**2,109**

Summary for Link 1L: Total

Inflow Area = 0.214 ac,100.00% Impervious, Inflow Depth = 3.27" for Jackson - 2 YR event
Inflow = 0.10 cfs @ 12.37 hrs, Volume= 0.058 af
Primary = 0.10 cfs @ 12.37 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Link 1L: Total



Hydrograph for Link 1L: Total

Time (hours)	Inflow (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	**0.00**	0.00
0.50	0.00	0.00	0.00
1.00	0.00	0.00	0.00
1.50	0.00	0.00	0.00
2.00	0.00	0.00	0.00
2.50	0.00	0.00	0.00
3.00	0.00	0.00	0.00
3.50	0.01	0.00	0.01
4.00	0.01	0.00	0.01
4.50	0.01	0.00	0.01
5.00	0.01	0.00	0.01
5.50	0.01	0.00	0.01
6.00	0.01	0.00	0.01
6.50	0.01	0.00	0.01
7.00	0.01	0.00	0.01
7.50	0.01	0.00	0.01
8.00	0.01	0.00	0.01
8.50	0.02	0.00	0.02
9.00	0.02	0.00	0.02
9.50	0.02	0.00	0.02
10.00	0.03	0.00	0.03
10.50	0.03	0.00	0.03
11.00	0.05	0.00	0.05
11.50	0.06	0.00	0.06
12.00	**0.08**	0.00	**0.08**
12.50	**0.10**	0.00	**0.10**
13.00	0.09	0.00	0.09
13.50	0.08	0.00	0.08
14.00	0.08	0.00	0.08
14.50	0.08	0.00	0.08
15.00	0.08	0.00	0.08
15.50	0.07	0.00	0.07
16.00	0.07	0.00	0.07
16.50	0.07	0.00	0.07
17.00	0.07	0.00	0.07
17.50	0.06	0.00	0.06
18.00	0.02	0.00	0.02
18.50	0.01	0.00	0.01
19.00	0.01	0.00	0.01
19.50	0.01	0.00	0.01
20.00	0.01	0.00	0.01
20.50	0.01	0.00	0.01
21.00	0.01	0.00	0.01
21.50	0.01	0.00	0.01
22.00	0.01	0.00	0.01
22.50	0.01	0.00	0.01
23.00	0.01	0.00	0.01
23.50	0.01	0.00	0.01
24.00	0.01	0.00	0.01
24.50	0.00	0.00	0.00
25.00	0.00	0.00	0.00
25.50	0.00	0.00	0.00
26.00	0.00	0.00	0.00
26.50	0.00	0.00	0.00
27.00	0.00	0.00	0.00
27.50	0.00	0.00	0.00
28.00	0.00	0.00	0.00
28.50	0.00	0.00	0.00
29.00	0.00	0.00	0.00
29.50	0.00	0.00	0.00
30.00	0.00	0.00	0.00
30.50	0.00	0.00	0.00
31.00	0.00	0.00	0.00
31.50	0.00	0.00	0.00
32.00	0.00	0.00	0.00
32.50	0.00	0.00	0.00
33.00	0.00	0.00	0.00
33.50	0.00	0.00	0.00
34.00	0.00	0.00	0.00
34.50	0.00	0.00	0.00
35.00	0.00	0.00	0.00
35.50	0.00	0.00	0.00
36.00	0.00	0.00	0.00
36.50	0.00	0.00	0.00
37.00	0.00	0.00	0.00
37.50	0.00	0.00	0.00
38.00	0.00	0.00	0.00
38.50	0.00	0.00	0.00
39.00	0.00	0.00	0.00
39.50	0.00	0.00	0.00
40.00	0.00	0.00	0.00
40.50	0.00	0.00	0.00
41.00	0.00	0.00	0.00
41.50	0.00	0.00	0.00
42.00	0.00	0.00	0.00
42.50	0.00	0.00	0.00
43.00	0.00	0.00	0.00
43.50	0.00	0.00	0.00
44.00	0.00	0.00	0.00
44.50	0.00	0.00	0.00
45.00	0.00	0.00	0.00
45.50	0.00	0.00	0.00
46.00	0.00	0.00	0.00
46.50	0.00	0.00	0.00
47.00	0.00	0.00	0.00
47.50	0.00	0.00	0.00
48.00	0.00	0.00	0.00

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Jackson County, Missouri

Downtown Lee's Summit Apartments

December 20, 2018

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

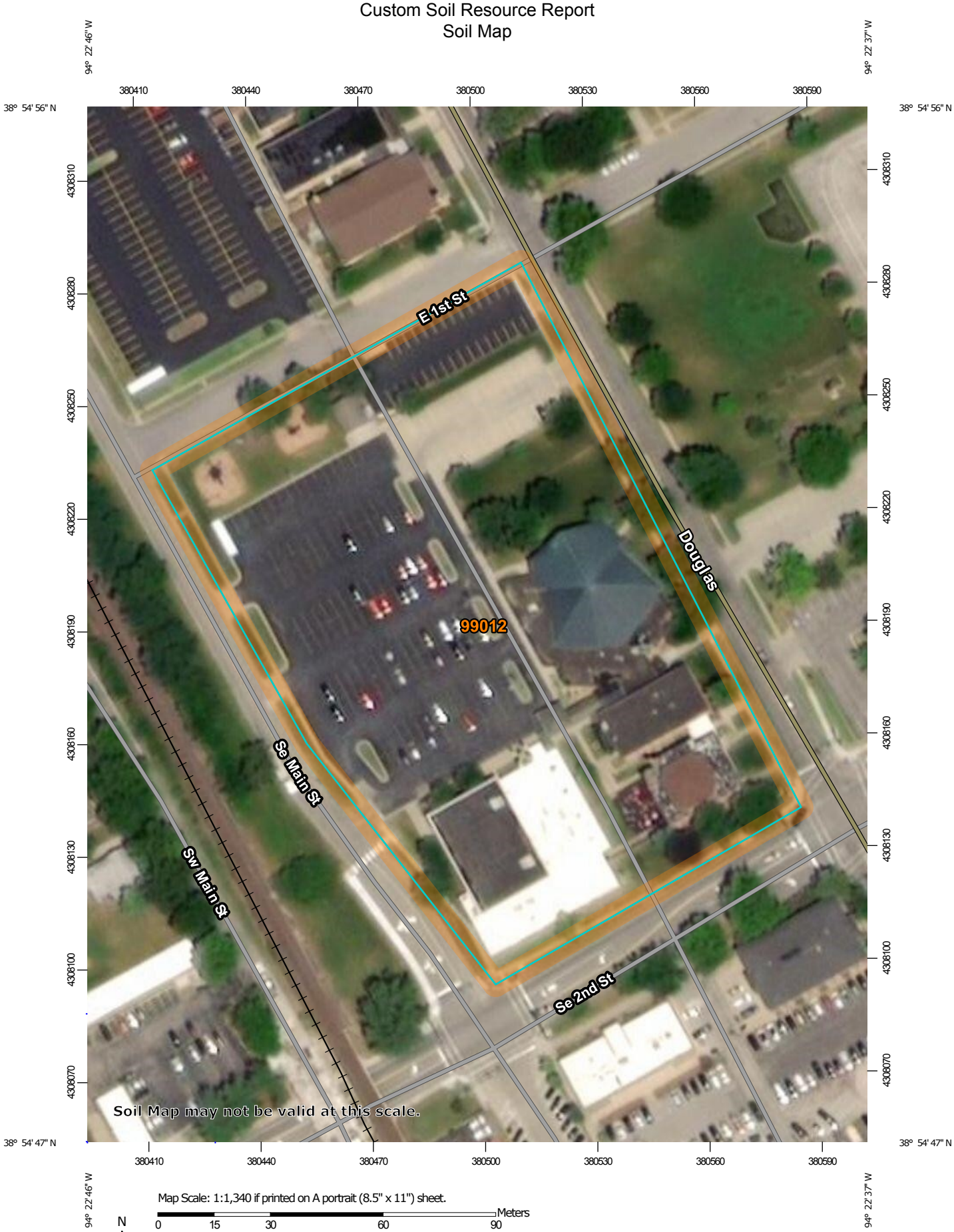
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,340 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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: Jackson County, Missouri
Survey Area Data: Version 19, Sep 13, 2018

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

Date(s) aerial images were photographed: Jun 11, 2017—Sep 22, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
99012	Urban land, upland, 5 to 9 percent slopes	4.3	100.0%
Totals for Area of Interest		**4.3**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Jackson County, Missouri

99012—Urban land, upland, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2q0qh
Mean annual precipitation: 36 to 43 inches
Frost-free period: 170 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 5 percent
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Concave
Ecological site: Deep Loess Upland Prairie (R107BY002MO)
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Harvester

Percent of map unit: 5 percent
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

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APPENDIX B

Details & Calculations

- Detention Design Details (to be included with final report)

MC-4500 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

STORMTECH MC-4500 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
52” x 100” x 60”
1,321 mm x 2,540 mm x 1,524 mm

Chamber Storage
106.5 ft^3 (3.01 m^3)

Min. Installed Storage*
162.6 ft^3 (4.60 m^3)

Weight
120 lbs (54.4 kg)

Shipping
7 chambers/pallet
11 pallets/truck

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below chambers, 9” (230 mm) of stone between chambers/end caps and 40% stone porosity.

STORMTECH MC-4500 END CAP
(not to scale)

Nominal End Cap Specifications

Size (L x W x H)
35.1” x 90.2” x 59.4”
891 mm x 2,291 mm x 1,509 mm

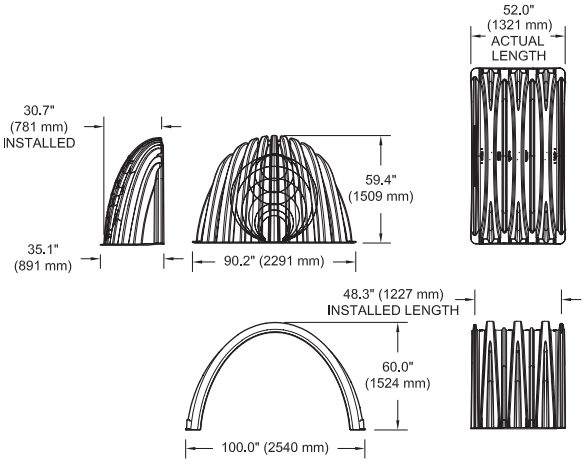
End Cap Storage
35.7 ft^3 (1.01 m^3)

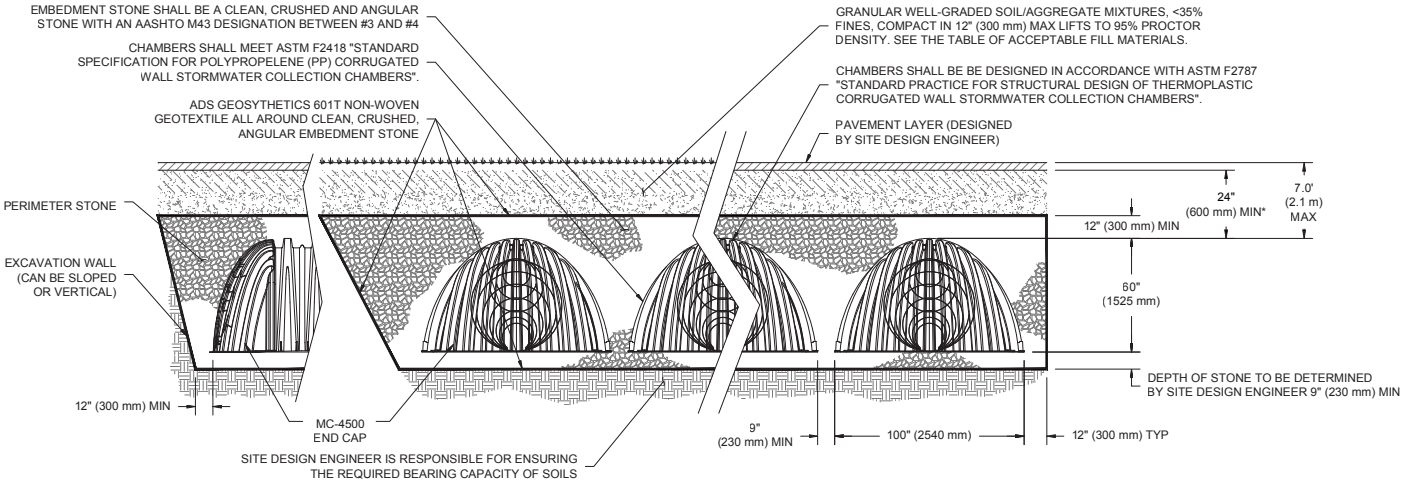
Min. Installed Storage*
108.7 ft^3 (3.08 m^3)

Weight
120 lbs (54.4 kg)

Shipping
7 end caps/pallet
11 pallets/truck

*Assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 6” (150 mm) of stone perimeter, 9” (230 mm) of stone between chambers/end caps and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

MC-4500 CHAMBER SPECIFICATIONS

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-4500 Chamber	106.5 (3.02)	162.6 (4.60)	166.3 (4.71)	169.6 (4.81)	173.6 (4.91)
MC-4500 End Cap	35.7 (1.0)	108.7 (3.08)	111.9 (3.17)	115.2 (3.26)	118.4 (3.35)

Note: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter.

AMOUNT OF STONE PER CHAMBER

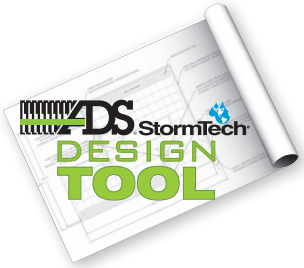
ENGLISH TONS (yds³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-4500 Chamber	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
MC-4500 End Cap	9.6 (6.8)	10.0 (7.1)	10.4 (7.4)	10.9 (7.7)
METRIC KILOGRAMS (m³)	230 mm	300 mm	375 mm	450 mm
MC-4500 Chamber	6,681 (4.0)	7,117 (4.2)	7,552 (4.5)	7,987 (4.7)
MC-4500 End Cap	8,691 (5.2)	9,075 (5.4)	9,460 (5.6)	9,845 (5.9)

Note: Assumes 12" (300 mm) of stone above and 9" (230 mm) row spacing and 12" (300 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-4500 Chamber	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
MC-4500 End Cap	9.3 (7.1)	9.6 (7.3)	9.9 (7.6)	10.2 (7.8)

Note: Assumes 9" (230 mm) of separation between chamber rows, 12" (300 mm) of perimeter in front of the end caps, and 24" (600 mm) of cover. The volume of excavation will varyas depth of cover increases.



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For more information on the StormTech MC-4500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

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