



down cape engineering, inc.

CIVIL ENGINEERS & LAND SURVEYORS
939 MAIN ST / ROUTE 6A YARMOUTHPORT, MA 02675
(508) 362-4541 FAX (508) 362-9880

Date: 8-1-15

DRAINAGE CALCULATIONS

PREPARED FOR

**WESTVIEW COURT REALTY TRUST,
MICHAEL TRIBUNA**

#7 PARKER DRIVE, TRURO, MA



D. Ojala

8-1-2015

Prepared for: Westview Court Realty Trust, Michael A. Tribuna, Jr. Trustee

8-1-15 DRAINAGE SUMMARY

DESIGN EVENT: 2,10,25,50 YEAR STORM EVENTS

The drainage systems specified for proposed regrading work at the residential cottage cluster at #7 Parker Drive in Truro, MA has been designed in accordance with the State Stormwater Management Guidelines.

The proposed drainage system utilizes overland flow to rock swales to a natural style bioretention area, which overflows to a deep sump hooded catch basin, then to subsurface infiltration to remove the required TSS and infiltrate the design storm from site. DA1 consists of the site as well as some of Parker Drive and land to the East of the drive. The largest rainfall event analyzed is a 50 year return frequency Type III Storm.

The HydroCAD drainage calculations and drainage area sketch plan are attached for reference.

Based on the attached drainage calculations the proposed drainage is adequate for the site.

SUMMARY:

USE THE PROPOSED CONVEYANCES TO THE NATURAL STYLE RETENTION AREA WITH OVERFLOW SUBSURFACE LEACHING SYSTEM AS SHOWN ON THE SITE PLANS DATED 7-30-2015 BY DOWN CAPE ENGINEERING, INC.

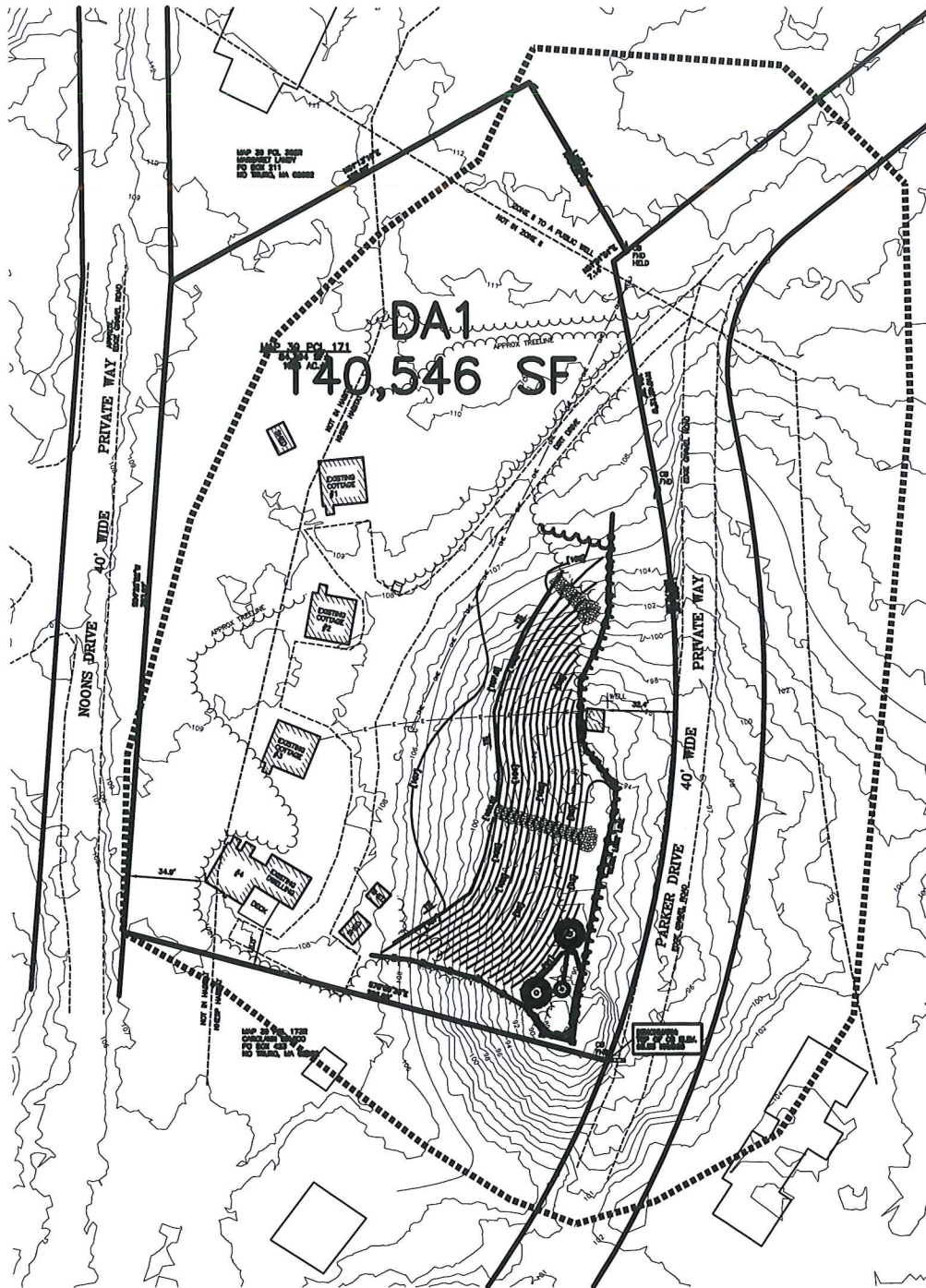
Prepared by:



Daniel A. Ojala PLS, PE
Down Cape Engineering, Inc.

date





DRAINAGE AREA

IN

TRURO, MA

#7 PARKER DRIVE

PREPARED FOR

MICHAEL TRIBUNA

SCALE: 1' = 80' DATE: JULY 31, 2015



off 508-362-4541
 fax 508-362-9880
 downcape.com ©

down cape engineering, inc.

*civil engineers
 land surveyors*

939 Main Street (Rte 6A)
 YARMOUTHPORT MA 02675

Figure B-3 2-year, 24-hr rainfall

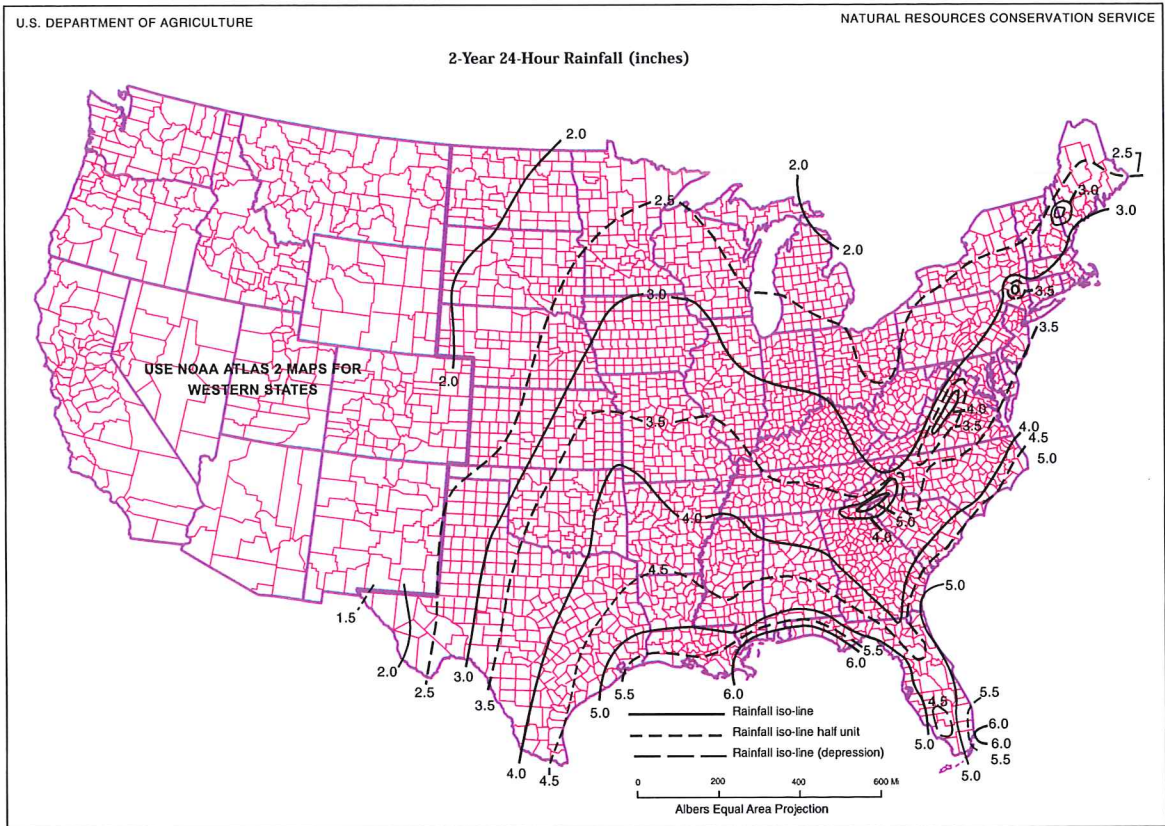


Figure B-4 5-year, 24-hour rainfall

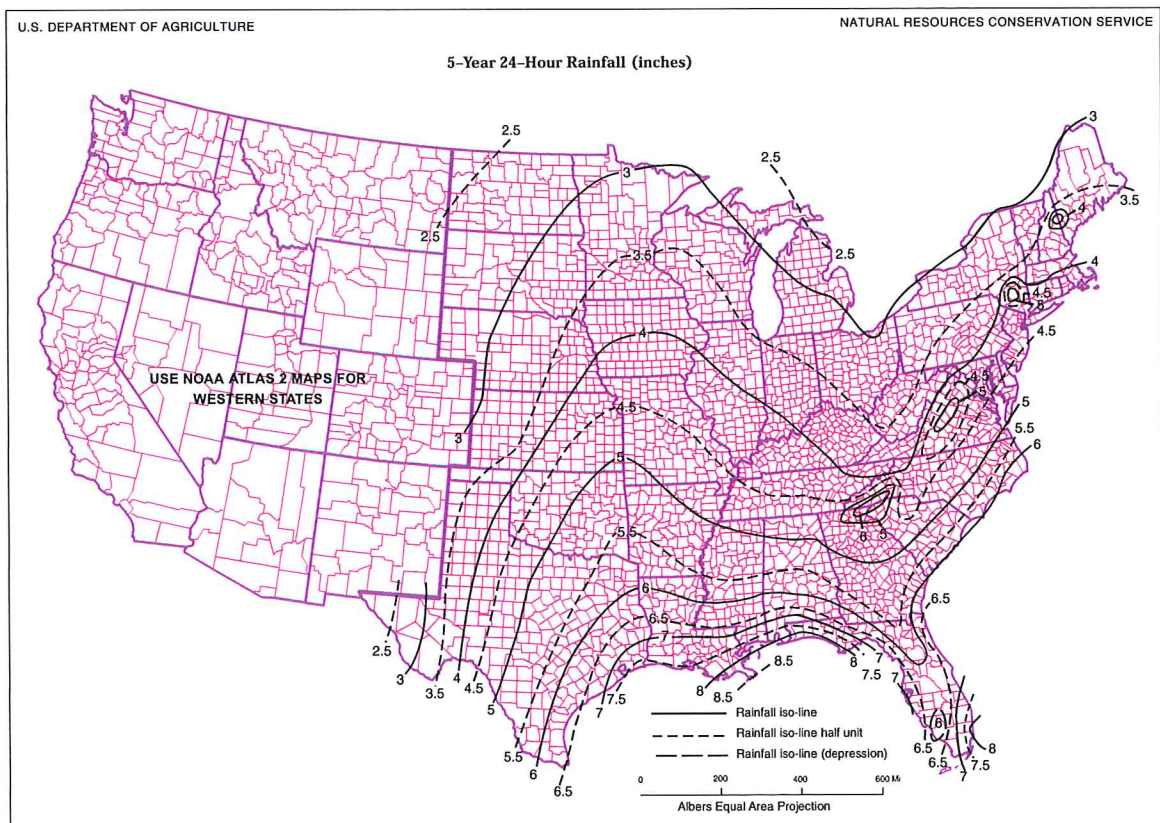


Figure B-5 10-year, 24-hour rainfall

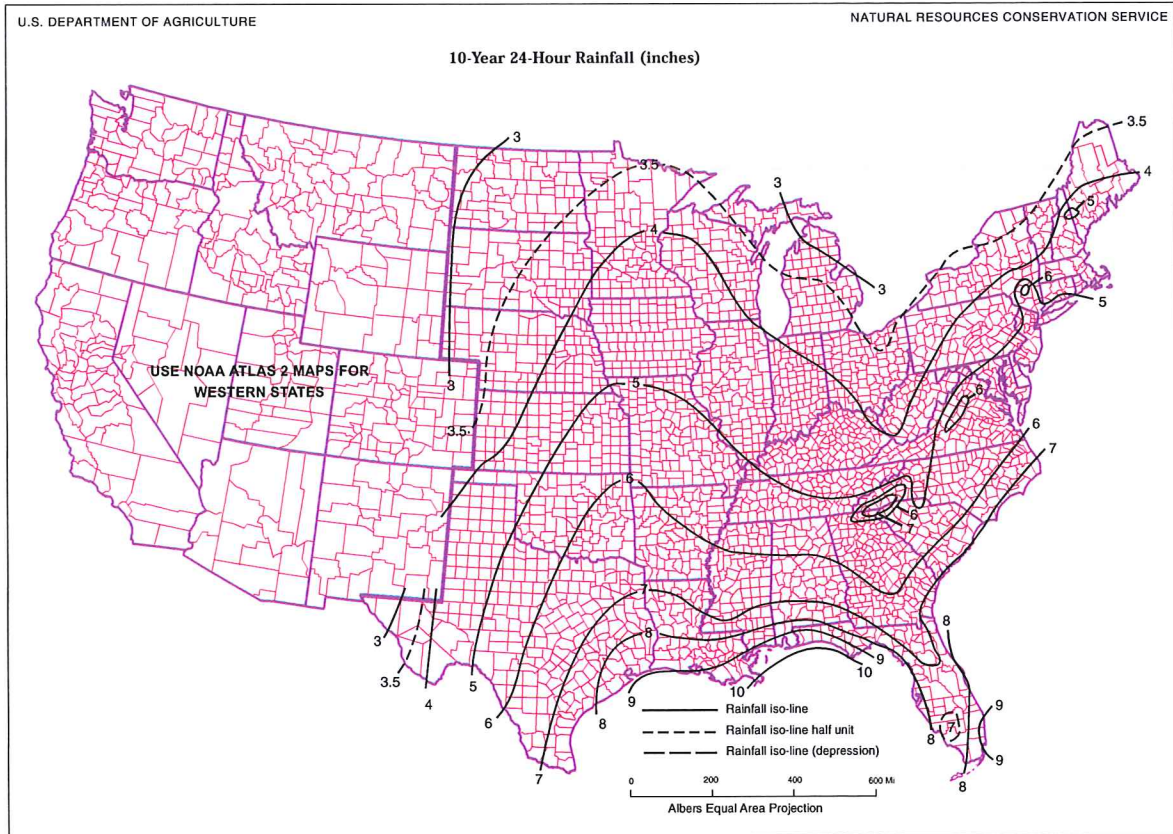


Figure B-6 25-year, 24-hour rainfall

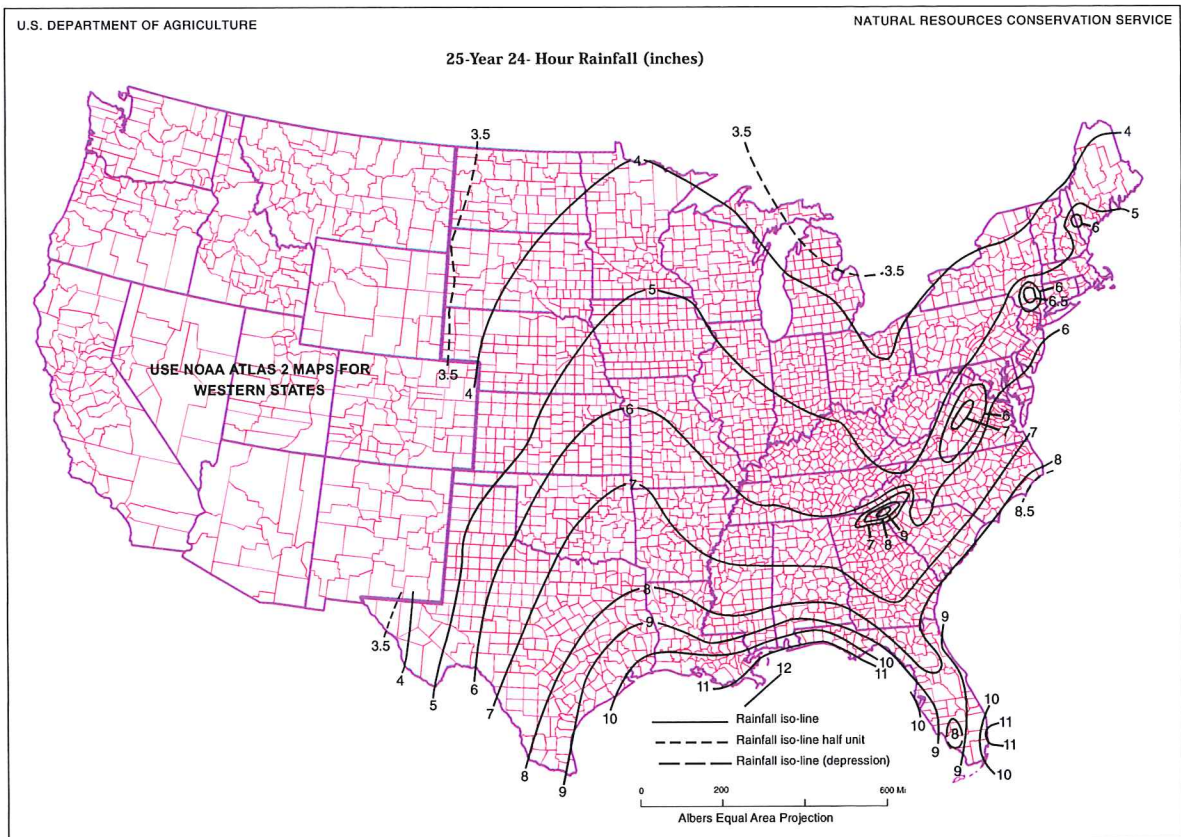


Figure B-7 50-year, 24-hour rainfall

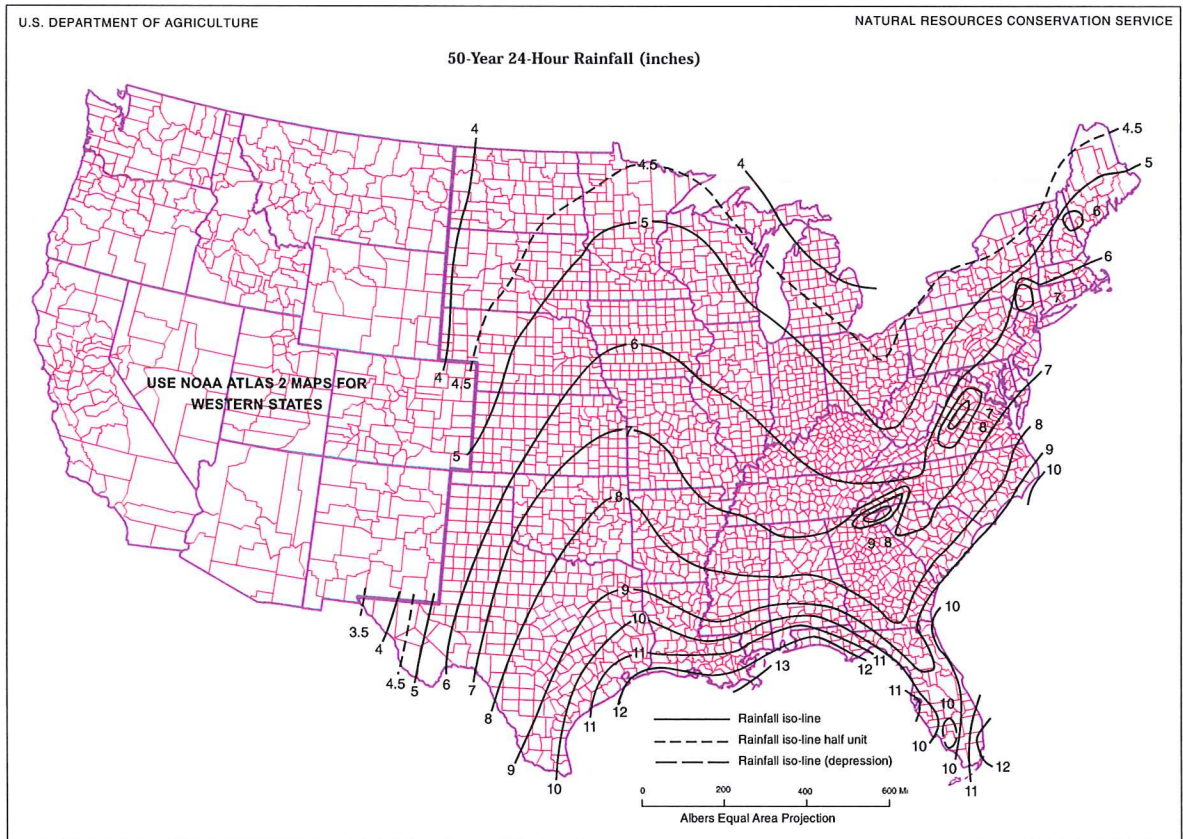
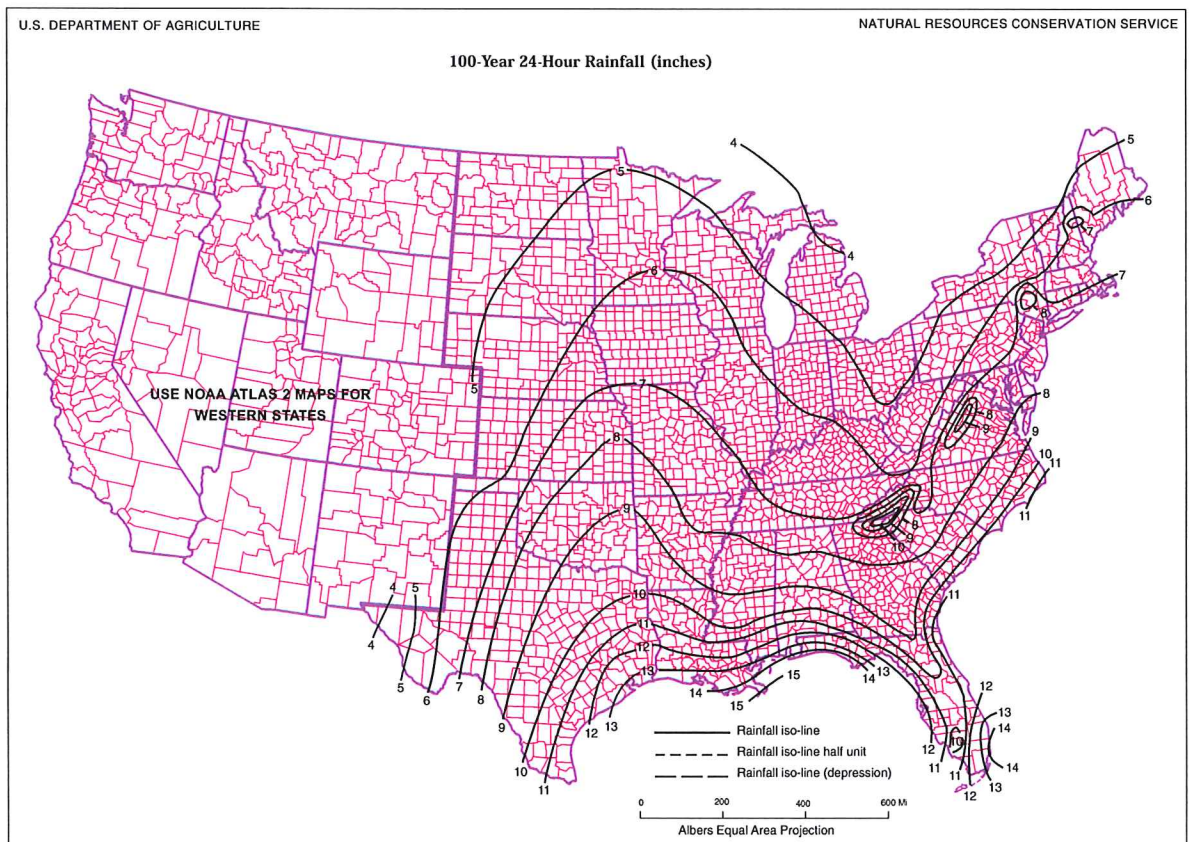
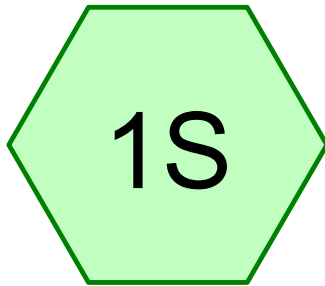
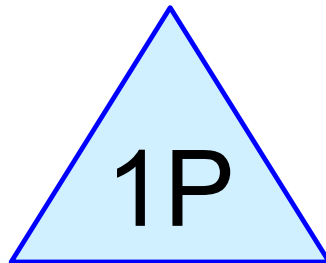
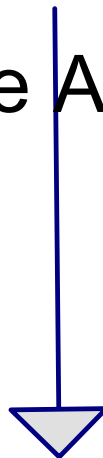


Figure B-8 100-year, 24-hour rainfall

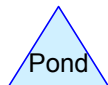
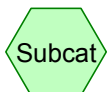




Drainage Area DA1



Bioretention Infiltration
Model with overflow



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Page 2

8/1/2015

Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
0.582	30	Woods, Good, HSG A (1S)
2.589	60	Gravel drives, driveways, parking (1S)
0.055	98	Buildings (1S)
<hr/>		
3.226		

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

2 Year 24 Hr Rainfall USDA NRCS

Type III 24-hr Rainfall=3.50"

Page 3

8/1/2015

Time span=1.00-20.00 hrs, dt=0.02 hrs, 951 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Drainage Area DA1

Runoff Area=140,546 sf Runoff Depth>0.29"

Tc=10.0 min CN=55 Runoff=0.52 cfs 0.079 af

Pond 1P: Bioretention Infiltration Model with overflow

Peak Elev=90.09' Storage=351 cf Inflow=0.52 cfs 0.079 af

Outflow=0.46 cfs 0.074 af

Total Runoff Area = 3.226 ac Runoff Volume = 0.079 af Average Runoff Depth = 0.29"

98.29% Pervious Area = 3.171 ac 1.71% Impervious Area = 0.055 ac

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.
 HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Subcatchment 1S: Drainage Area DA1

Time of Concentration

Runoff = 0.52 cfs @ 12.34 hrs, Volume= 0.079 af, Depth> 0.29"

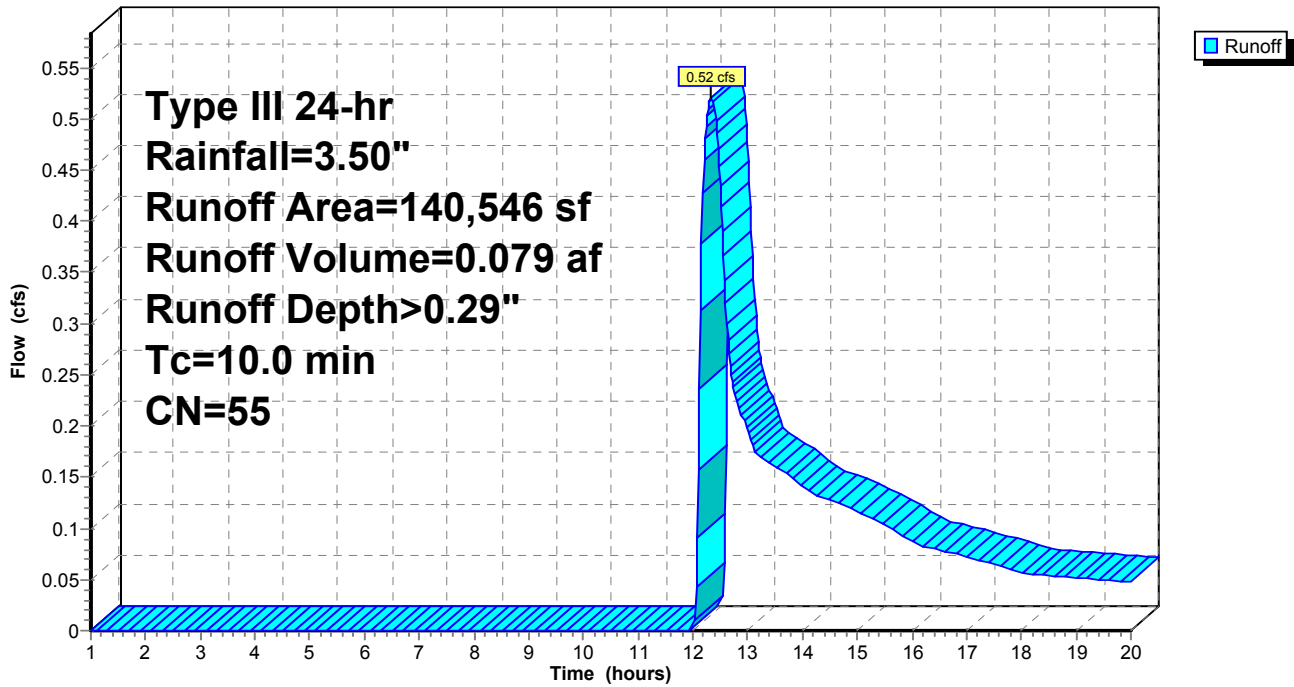
Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.02 hrs
 Type III 24-hr Rainfall=3.50"

Area (sf)	CN	Description
2,400	98	Buildings
25,371	30	Woods, Good, HSG A
112,775	60	Gravel drives, driveways, parking
140,546	55	Weighted Average
138,146		Pervious Area
2,400		Impervious Area

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

Subcatchment 1S: Drainage Area DA1

Hydrograph



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

2 Year 24 Hr Rainfall USDA NRCS

Type III 24-hr Rainfall=3.50"

Page 5

8/1/2015

Hydrograph for Subcatchment 1S: Drainage Area DA1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
1.00	0.04	0.00	0.00	11.60	1.10	0.00	0.00
1.20	0.04	0.00	0.00	11.80	1.31	0.00	0.00
1.40	0.05	0.00	0.00	12.00	1.75	0.00	0.00
1.60	0.06	0.00	0.00	12.20	2.19	0.04	0.46
1.80	0.06	0.00	0.00	12.40	2.40	0.07	0.51
2.00	0.07	0.00	0.00	12.60	2.50	0.08	0.32
2.20	0.08	0.00	0.00	12.80	2.57	0.10	0.23
2.40	0.08	0.00	0.00	13.00	2.62	0.11	0.19
2.60	0.09	0.00	0.00	13.20	2.67	0.12	0.17
2.80	0.10	0.00	0.00	13.40	2.72	0.13	0.16
3.00	0.11	0.00	0.00	13.60	2.76	0.14	0.16
3.20	0.12	0.00	0.00	13.80	2.80	0.15	0.15
3.40	0.12	0.00	0.00	14.00	2.84	0.15	0.14
3.60	0.13	0.00	0.00	14.20	2.87	0.16	0.13
3.80	0.14	0.00	0.00	14.40	2.90	0.17	0.13
4.00	0.15	0.00	0.00	14.60	2.93	0.18	0.13
4.20	0.16	0.00	0.00	14.80	2.96	0.19	0.12
4.40	0.17	0.00	0.00	15.00	2.99	0.19	0.12
4.60	0.18	0.00	0.00	15.20	3.02	0.20	0.11
4.80	0.19	0.00	0.00	15.40	3.04	0.21	0.11
5.00	0.20	0.00	0.00	15.60	3.06	0.21	0.10
5.20	0.21	0.00	0.00	15.80	3.08	0.22	0.09
5.40	0.22	0.00	0.00	16.00	3.10	0.22	0.09
5.60	0.23	0.00	0.00	16.20	3.12	0.23	0.08
5.80	0.24	0.00	0.00	16.40	3.14	0.23	0.08
6.00	0.25	0.00	0.00	16.60	3.15	0.24	0.08
6.20	0.26	0.00	0.00	16.80	3.17	0.24	0.07
6.40	0.28	0.00	0.00	17.00	3.18	0.25	0.07
6.60	0.29	0.00	0.00	17.20	3.20	0.25	0.07
6.80	0.30	0.00	0.00	17.40	3.21	0.25	0.07
7.00	0.32	0.00	0.00	17.60	3.22	0.26	0.06
7.20	0.33	0.00	0.00	17.80	3.24	0.26	0.06
7.40	0.35	0.00	0.00	18.00	3.25	0.27	0.06
7.60	0.36	0.00	0.00	18.20	3.26	0.27	0.06
7.80	0.38	0.00	0.00	18.40	3.27	0.27	0.05
8.00	0.40	0.00	0.00	18.60	3.28	0.28	0.05
8.20	0.42	0.00	0.00	18.80	3.29	0.28	0.05
8.40	0.44	0.00	0.00	19.00	3.30	0.28	0.05
8.60	0.46	0.00	0.00	19.20	3.31	0.28	0.05
8.80	0.48	0.00	0.00	19.40	3.32	0.29	0.05
9.00	0.51	0.00	0.00	19.60	3.33	0.29	0.05
9.20	0.54	0.00	0.00	19.80	3.34	0.29	0.05
9.40	0.57	0.00	0.00	20.00	3.35	0.30	0.05
9.60	0.60	0.00	0.00				
9.80	0.63	0.00	0.00				
10.00	0.66	0.00	0.00				
10.20	0.70	0.00	0.00				
10.40	0.74	0.00	0.00				
10.60	0.78	0.00	0.00				
10.80	0.83	0.00	0.00				
11.00	0.88	0.00	0.00				
11.20	0.93	0.00	0.00				
11.40	1.00	0.00	0.00				

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.
 HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Pond 1P: Bioretention Infiltration Model with overflow

Grass lined bioinfiltration area with overflow infiltration

Inflow Area = 3.226 ac, Inflow Depth > 0.29"
 Inflow = 0.52 cfs @ 12.34 hrs, Volume= 0.079 af
 Outflow = 0.46 cfs @ 12.47 hrs, Volume= 0.074 af, Atten= 12%, Lag= 8.2 min
 Primary = 0.46 cfs @ 12.47 hrs, Volume= 0.074 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.02 hrs
 Peak Elev= 90.09' @ 12.47 hrs Surf.Area= 0 sf Storage= 351 cf

Plug-Flow detention time=33.1 min calculated for 0.074 af (93% of inflow)
 Center-of-Mass det. time=13.1 min (889.8 - 876.6)

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	4,000 cf	Infiltration System Storage Model Listed below

Elevation (feet)	Cum.Store (cubic-feet)
89.00	0
89.20	100
90.00	220
91.00	1,609
92.00	2,002
93.00	3,019
94.00	4,000

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	Infiltration Model Elev. (feet) 89.00 89.20 90.00 90.30 92.00 93.00 94.00 Disch. (cfs) 0.000 0.030 0.030 1.400 1.600 1.800 1.900

Primary OutFlow Max=0.46 cfs @ 12.47 hrs HW=90.09' (Free Discharge)
 ↑1=**Infiltration Model** (Custom Controls 0.46 cfs)

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

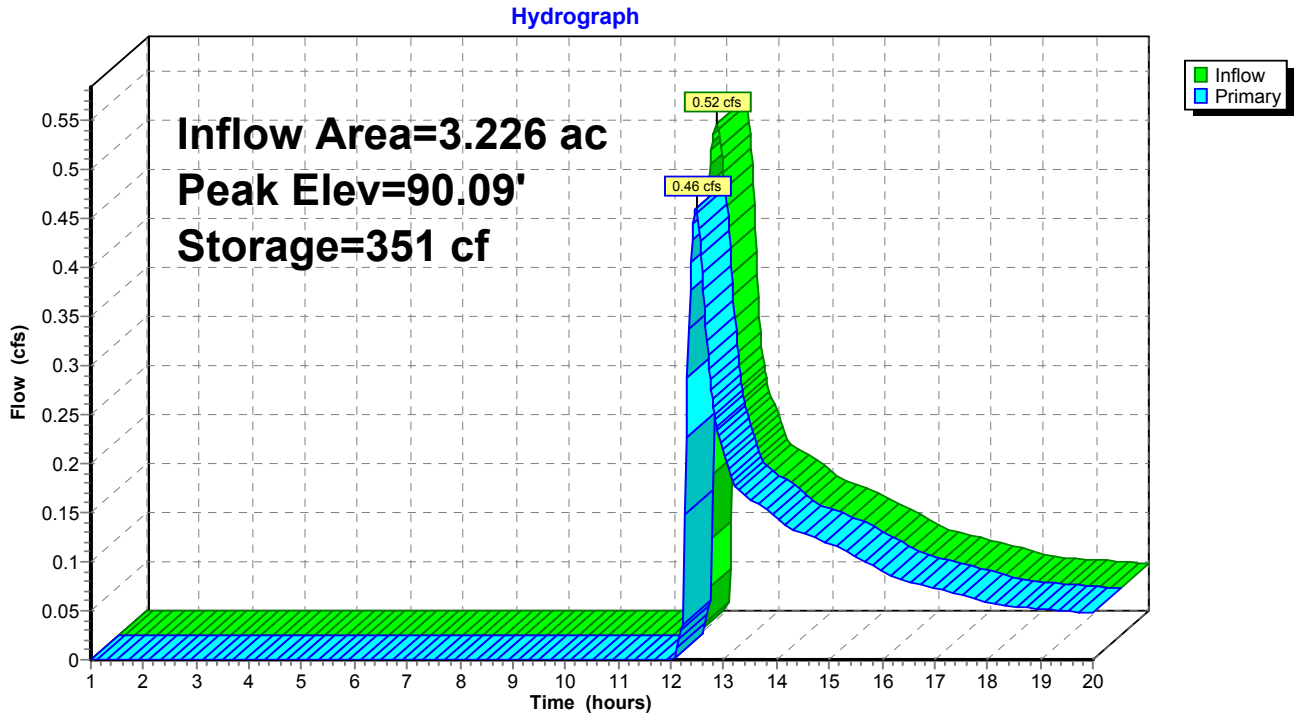
2 Year 24 Hr Rainfall USDA NRCS

Type III 24-hr Rainfall=3.50"

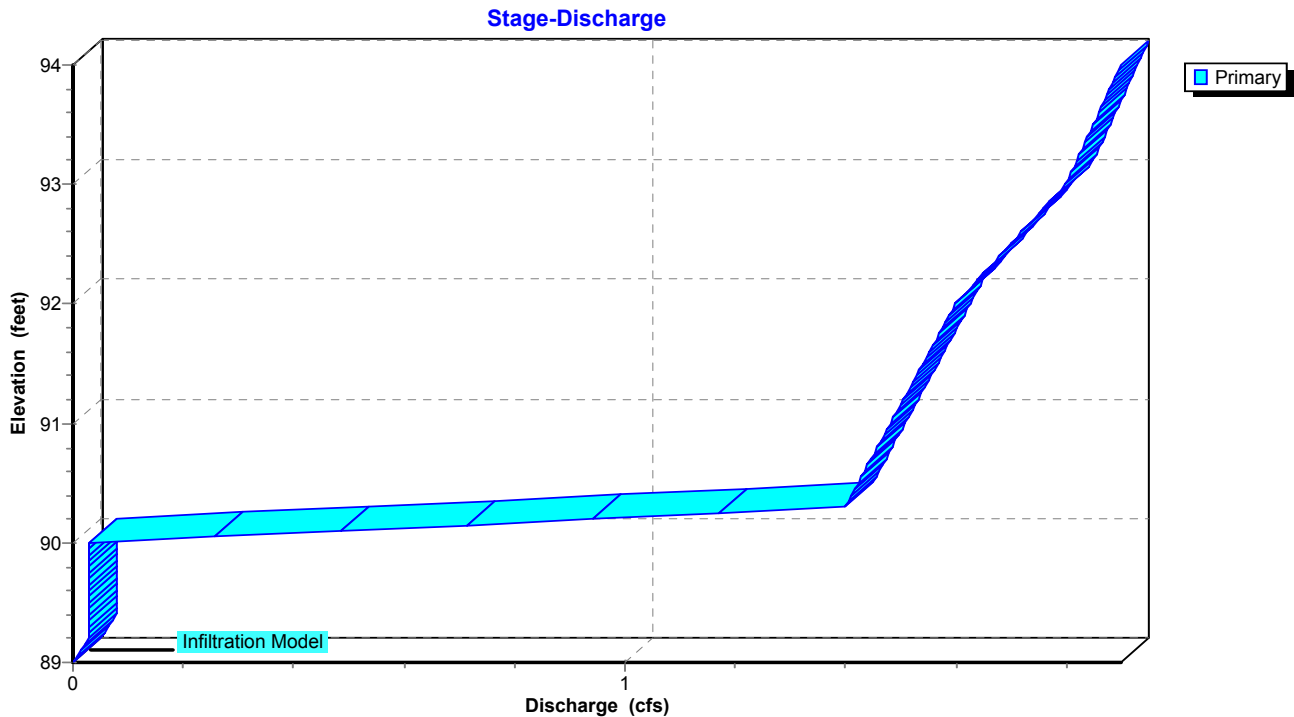
Page 7

8/1/2015

Pond 1P: Bioretention Infiltration Model with overflow



Pond 1P: Bioretention Infiltration Model with overflow



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

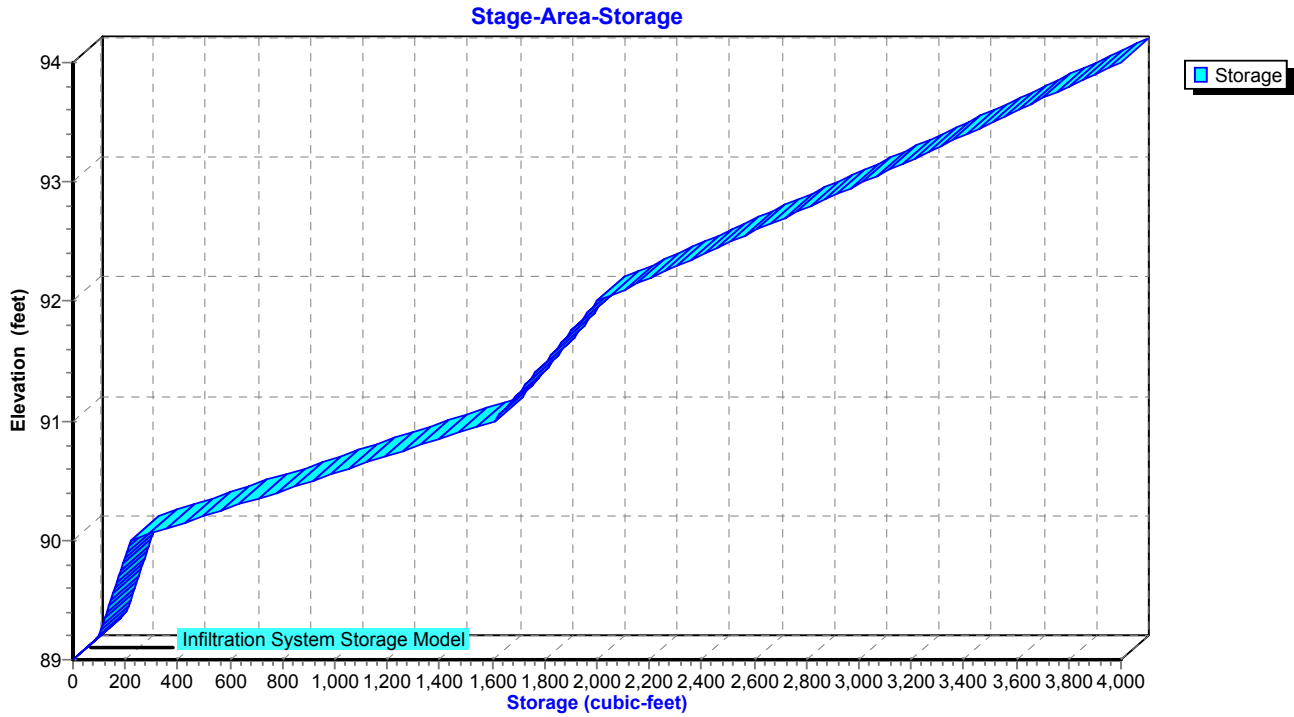
2 Year 24 Hr Rainfall USDA NRCS

Type III 24-hr Rainfall=3.50"

Page 8

8/1/2015

Pond 1P: Bioretention Infiltration Model with overflow



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

2 Year 24 Hr Rainfall USDA NRCS

Type III 24-hr Rainfall=3.50"

Page 9

8/1/2015

Hydrograph for Pond 1P: Bioretention Infiltration Model with overflow

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
1.00	0.00	0	89.00	0.00	11.60	0.00	0	89.00	0.00
1.20	0.00	0	89.00	0.00	11.80	0.00	0	89.00	0.00
1.40	0.00	0	89.00	0.00	12.00	0.00	0	89.00	0.00
1.60	0.00	0	89.00	0.00	12.20	0.46	129	89.40	0.03
1.80	0.00	0	89.00	0.00	12.40	0.51	341	90.09	0.43
2.00	0.00	0	89.00	0.00	12.60	0.32	331	90.08	0.39
2.20	0.00	0	89.00	0.00	12.80	0.23	289	90.05	0.26
2.40	0.00	0	89.00	0.00	13.00	0.19	274	90.04	0.21
2.60	0.00	0	89.00	0.00	13.20	0.17	265	90.03	0.18
2.80	0.00	0	89.00	0.00	13.40	0.16	262	90.03	0.17
3.00	0.00	0	89.00	0.00	13.60	0.16	260	90.03	0.16
3.20	0.00	0	89.00	0.00	13.80	0.15	257	90.03	0.15
3.40	0.00	0	89.00	0.00	14.00	0.14	255	90.03	0.14
3.60	0.00	0	89.00	0.00	14.20	0.13	252	90.02	0.14
3.80	0.00	0	89.00	0.00	14.40	0.13	251	90.02	0.13
4.00	0.00	0	89.00	0.00	14.60	0.13	250	90.02	0.13
4.20	0.00	0	89.00	0.00	14.80	0.12	248	90.02	0.12
4.40	0.00	0	89.00	0.00	15.00	0.12	247	90.02	0.12
4.60	0.00	0	89.00	0.00	15.20	0.11	245	90.02	0.11
4.80	0.00	0	89.00	0.00	15.40	0.11	244	90.02	0.11
5.00	0.00	0	89.00	0.00	15.60	0.10	242	90.02	0.10
5.20	0.00	0	89.00	0.00	15.80	0.09	240	90.01	0.10
5.40	0.00	0	89.00	0.00	16.00	0.09	238	90.01	0.09
5.60	0.00	0	89.00	0.00	16.20	0.08	237	90.01	0.08
5.80	0.00	0	89.00	0.00	16.40	0.08	236	90.01	0.08
6.00	0.00	0	89.00	0.00	16.60	0.08	235	90.01	0.08
6.20	0.00	0	89.00	0.00	16.80	0.07	234	90.01	0.08
6.40	0.00	0	89.00	0.00	17.00	0.07	233	90.01	0.07
6.60	0.00	0	89.00	0.00	17.20	0.07	232	90.01	0.07
6.80	0.00	0	89.00	0.00	17.40	0.07	231	90.01	0.07
7.00	0.00	0	89.00	0.00	17.60	0.06	231	90.01	0.06
7.20	0.00	0	89.00	0.00	17.80	0.06	230	90.01	0.06
7.40	0.00	0	89.00	0.00	18.00	0.06	229	90.01	0.06
7.60	0.00	0	89.00	0.00	18.20	0.06	228	90.01	0.06
7.80	0.00	0	89.00	0.00	18.40	0.05	227	90.01	0.05
8.00	0.00	0	89.00	0.00	18.60	0.05	227	90.01	0.05
8.20	0.00	0	89.00	0.00	18.80	0.05	227	90.01	0.05
8.40	0.00	0	89.00	0.00	19.00	0.05	227	90.00	0.05
8.60	0.00	0	89.00	0.00	19.20	0.05	226	90.00	0.05
8.80	0.00	0	89.00	0.00	19.40	0.05	226	90.00	0.05
9.00	0.00	0	89.00	0.00	19.60	0.05	226	90.00	0.05
9.20	0.00	0	89.00	0.00	19.80	0.05	226	90.00	0.05
9.40	0.00	0	89.00	0.00	20.00	0.05	225	90.00	0.05
9.60	0.00	0	89.00	0.00					
9.80	0.00	0	89.00	0.00					
10.00	0.00	0	89.00	0.00					
10.20	0.00	0	89.00	0.00					
10.40	0.00	0	89.00	0.00					
10.60	0.00	0	89.00	0.00					
10.80	0.00	0	89.00	0.00					
11.00	0.00	0	89.00	0.00					
11.20	0.00	0	89.00	0.00					
11.40	0.00	0	89.00	0.00					

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

2 Year 24 Hr Rainfall USDA NRCS

Type III 24-hr Rainfall=3.50"

Page 10

8/1/2015

Stage-Discharge for Pond 1P: Bioretention Infiltration Model with overflow

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
89.00	0.00	90.06	0.30	91.12	1.50	92.18	1.64	93.24	1.82
89.02	0.00	90.08	0.40	91.14	1.50	92.20	1.64	93.26	1.83
89.04	0.01	90.10	0.49	91.16	1.50	92.22	1.64	93.28	1.83
89.06	0.01	90.12	0.58	91.18	1.50	92.24	1.65	93.30	1.83
89.08	0.01	90.14	0.67	91.20	1.51	92.26	1.65	93.32	1.83
89.10	0.01	90.16	0.76	91.22	1.51	92.28	1.66	93.34	1.83
89.12	0.02	90.18	0.85	91.24	1.51	92.30	1.66	93.36	1.84
89.14	0.02	90.20	0.94	91.26	1.51	92.32	1.66	93.38	1.84
89.16	0.02	90.22	1.03	91.28	1.52	92.34	1.67	93.40	1.84
89.18	0.03	90.24	1.13	91.30	1.52	92.36	1.67	93.42	1.84
89.20	0.03	90.26	1.22	91.32	1.52	92.38	1.68	93.44	1.84
89.22	0.03	90.28	1.31	91.34	1.52	92.40	1.68	93.46	1.85
89.24	0.03	90.30	1.40	91.36	1.52	92.42	1.68	93.48	1.85
89.26	0.03	90.32	1.40	91.38	1.53	92.44	1.69	93.50	1.85
89.28	0.03	90.34	1.40	91.40	1.53	92.46	1.69	93.52	1.85
89.30	0.03	90.36	1.41	91.42	1.53	92.48	1.70	93.54	1.85
89.32	0.03	90.38	1.41	91.44	1.53	92.50	1.70	93.56	1.86
89.34	0.03	90.40	1.41	91.46	1.54	92.52	1.70	93.58	1.86
89.36	0.03	90.42	1.41	91.48	1.54	92.54	1.71	93.60	1.86
89.38	0.03	90.44	1.42	91.50	1.54	92.56	1.71	93.62	1.86
89.40	0.03	90.46	1.42	91.52	1.54	92.58	1.72	93.64	1.86
89.42	0.03	90.48	1.42	91.54	1.55	92.60	1.72	93.66	1.87
89.44	0.03	90.50	1.42	91.56	1.55	92.62	1.72	93.68	1.87
89.46	0.03	90.52	1.43	91.58	1.55	92.64	1.73	93.70	1.87
89.48	0.03	90.54	1.43	91.60	1.55	92.66	1.73	93.72	1.87
89.50	0.03	90.56	1.43	91.62	1.56	92.68	1.74	93.74	1.87
89.52	0.03	90.58	1.43	91.64	1.56	92.70	1.74	93.76	1.88
89.54	0.03	90.60	1.44	91.66	1.56	92.72	1.74	93.78	1.88
89.56	0.03	90.62	1.44	91.68	1.56	92.74	1.75	93.80	1.88
89.58	0.03	90.64	1.44	91.70	1.56	92.76	1.75	93.82	1.88
89.60	0.03	90.66	1.44	91.72	1.57	92.78	1.76	93.84	1.88
89.62	0.03	90.68	1.44	91.74	1.57	92.80	1.76	93.86	1.89
89.64	0.03	90.70	1.45	91.76	1.57	92.82	1.76	93.88	1.89
89.66	0.03	90.72	1.45	91.78	1.57	92.84	1.77	93.90	1.89
89.68	0.03	90.74	1.45	91.80	1.58	92.86	1.77	93.92	1.89
89.70	0.03	90.76	1.45	91.82	1.58	92.88	1.78	93.94	1.89
89.72	0.03	90.78	1.46	91.84	1.58	92.90	1.78	93.96	1.90
89.74	0.03	90.80	1.46	91.86	1.58	92.92	1.78	93.98	1.90
89.76	0.03	90.82	1.46	91.88	1.59	92.94	1.79	94.00	1.90
89.78	0.03	90.84	1.46	91.90	1.59	92.96	1.79		
89.80	0.03	90.86	1.47	91.92	1.59	92.98	1.80		
89.82	0.03	90.88	1.47	91.94	1.59	93.00	1.80		
89.84	0.03	90.90	1.47	91.96	1.60	93.02	1.80		
89.86	0.03	90.92	1.47	91.98	1.60	93.04	1.80		
89.88	0.03	90.94	1.48	92.00	1.60	93.06	1.81		
89.90	0.03	90.96	1.48	92.02	1.60	93.08	1.81		
89.92	0.03	90.98	1.48	92.04	1.61	93.10	1.81		
89.94	0.03	91.00	1.48	92.06	1.61	93.12	1.81		
89.96	0.03	91.02	1.48	92.08	1.62	93.14	1.81		
89.98	0.03	91.04	1.49	92.10	1.62	93.16	1.82		
90.00	0.03	91.06	1.49	92.12	1.62	93.18	1.82		
90.02	0.12	91.08	1.49	92.14	1.63	93.20	1.82		
90.04	0.21	91.10	1.49	92.16	1.63	93.22	1.82		

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

2 Year 24 Hr Rainfall USDA NRCS

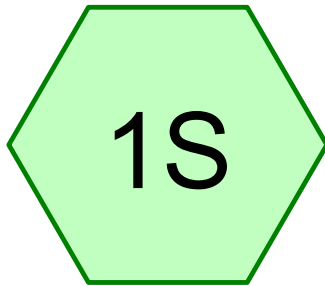
Type III 24-hr Rainfall=3.50"

Page 11

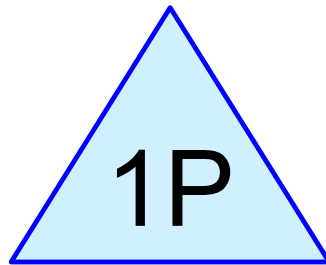
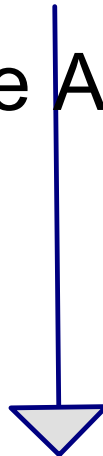
8/1/2015

Stage-Area-Storage for Pond 1P: Bioretention Infiltration Model with overflow

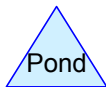
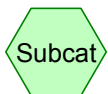
Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
89.00	0	91.65	1,864
89.05	25	91.70	1,884
89.10	50	91.75	1,904
89.15	75	91.80	1,923
89.20	100	91.85	1,943
89.25	107	91.90	1,963
89.30	115	91.95	1,982
89.35	122	92.00	2,002
89.40	130	92.05	2,053
89.45	138	92.10	2,104
89.50	145	92.15	2,155
89.55	152	92.20	2,205
89.60	160	92.25	2,256
89.65	168	92.30	2,307
89.70	175	92.35	2,358
89.75	182	92.40	2,409
89.80	190	92.45	2,460
89.85	197	92.50	2,511
89.90	205	92.55	2,561
89.95	213	92.60	2,612
90.00	220	92.65	2,663
90.05	289	92.70	2,714
90.10	359	92.75	2,765
90.15	428	92.80	2,816
90.20	498	92.85	2,866
90.25	567	92.90	2,917
90.30	637	92.95	2,968
90.35	706	93.00	3,019
90.40	776	93.05	3,068
90.45	845	93.10	3,117
90.50	915	93.15	3,166
90.55	984	93.20	3,215
90.60	1,053	93.25	3,264
90.65	1,123	93.30	3,313
90.70	1,192	93.35	3,362
90.75	1,262	93.40	3,411
90.80	1,331	93.45	3,460
90.85	1,401	93.50	3,510
90.90	1,470	93.55	3,559
90.95	1,540	93.60	3,608
91.00	1,609	93.65	3,657
91.05	1,629	93.70	3,706
91.10	1,648	93.75	3,755
91.15	1,668	93.80	3,804
91.20	1,688	93.85	3,853
91.25	1,707	93.90	3,902
91.30	1,727	93.95	3,951
91.35	1,747	94.00	4,000
91.40	1,766		
91.45	1,786		
91.50	1,806		
91.55	1,825		
91.60	1,845		



Drainage Area DA1



Bioretention Infiltration Model with overflow



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Page 2

7/31/2015

Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
0.582	30	Woods, Good, HSG A (1S)
2.589	60	Gravel drives, driveways, parking (1S)
0.055	98	Buildings (1S)
<hr/>		
3.226		

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Page 3

7/31/2015

Time span=1.00-20.00 hrs, dt=0.02 hrs, 951 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Drainage Area DA1

Runoff Area=140,546 sf Runoff Depth>1.21"

Tc=6.0 min CN=55 Runoff=4.42 cfs 0.326 af

Pond 1P: Bioretention Infiltration Model with overflow

Peak Elev=92.85' Storage=2,866 cf Inflow=4.42 cfs 0.326 af

Outflow=1.58 cfs 0.320 af

Total Runoff Area = 3.226 ac Runoff Volume = 0.326 af Average Runoff Depth = 1.21"

98.29% Pervious Area = 3.171 ac 1.71% Impervious Area = 0.055 ac

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.
HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Page 4
7/31/2015

Subcatchment 1S: Drainage Area DA1

Time of Concentration

Runoff = 4.42 cfs @ 12.10 hrs, Volume= 0.326 af, Depth> 1.21"

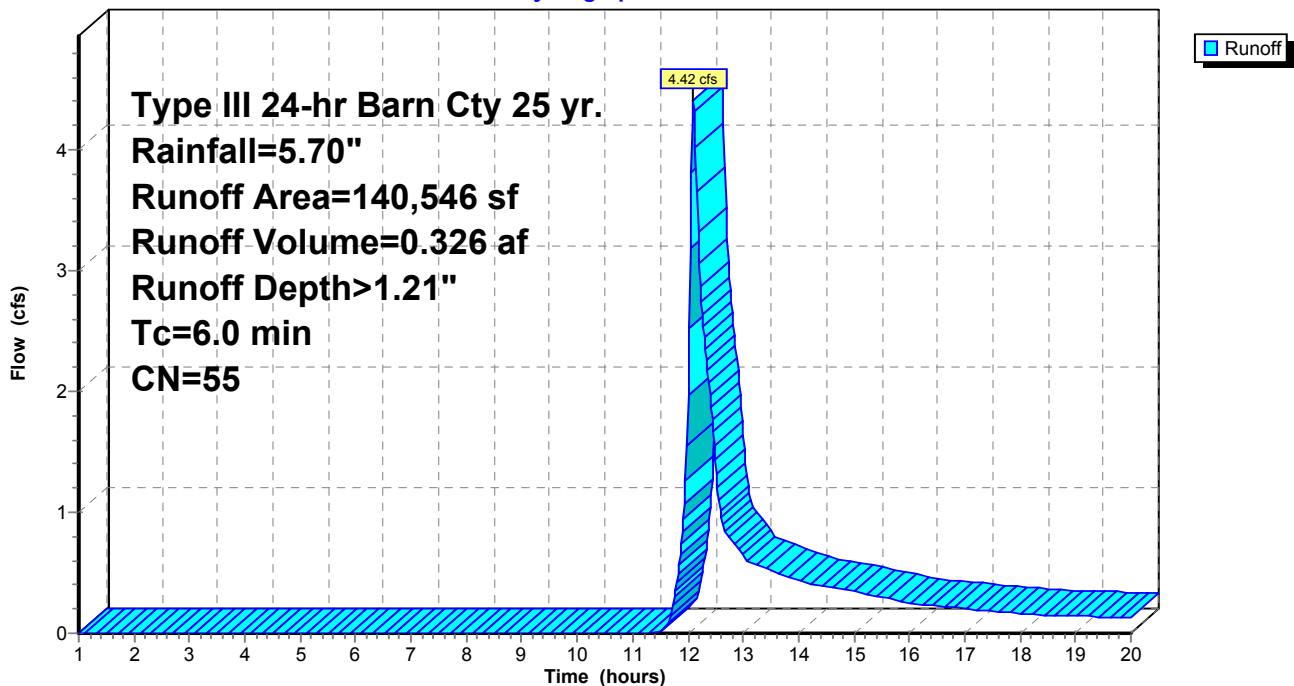
Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.02 hrs
Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Area (sf)	CN	Description
2,400	98	Buildings
25,371	30	Woods, Good, HSG A
112,775	60	Gravel drives, driveways, parking
140,546	55	Weighted Average
138,146		Pervious Area
2,400		Impervious Area

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

Subcatchment 1S: Drainage Area DA1

Hydrograph



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Page 5

7/31/2015

Hydrograph for Subcatchment 1S: Drainage Area DA1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
1.00	0.06	0.00	0.00	11.80	2.13	0.03	0.42
1.20	0.07	0.00	0.00	12.00	2.85	0.16	1.97
1.40	0.08	0.00	0.00	12.20	3.57	0.37	3.06
1.60	0.09	0.00	0.00	12.40	3.91	0.49	1.98
1.80	0.10	0.00	0.00	12.60	4.07	0.56	0.95
2.00	0.11	0.00	0.00	12.80	4.18	0.60	0.76
2.20	0.13	0.00	0.00	13.00	4.27	0.64	0.64
2.40	0.14	0.00	0.00	13.20	4.36	0.68	0.57
2.60	0.15	0.00	0.00	13.40	4.43	0.71	0.54
2.80	0.16	0.00	0.00	13.60	4.50	0.74	0.51
3.00	0.18	0.00	0.00	13.80	4.56	0.77	0.47
3.20	0.19	0.00	0.00	14.00	4.62	0.80	0.44
3.40	0.20	0.00	0.00	14.20	4.68	0.82	0.41
3.60	0.22	0.00	0.00	14.40	4.73	0.85	0.40
3.80	0.23	0.00	0.00	14.60	4.78	0.87	0.38
4.00	0.25	0.00	0.00	14.80	4.83	0.89	0.36
4.20	0.26	0.00	0.00	15.00	4.87	0.92	0.35
4.40	0.28	0.00	0.00	15.20	4.91	0.94	0.33
4.60	0.29	0.00	0.00	15.40	4.95	0.95	0.31
4.80	0.31	0.00	0.00	15.60	4.99	0.97	0.29
5.00	0.32	0.00	0.00	15.80	5.02	0.99	0.27
5.20	0.34	0.00	0.00	16.00	5.05	1.01	0.25
5.40	0.36	0.00	0.00	16.20	5.08	1.02	0.24
5.60	0.37	0.00	0.00	16.40	5.11	1.03	0.23
5.80	0.39	0.00	0.00	16.60	5.13	1.05	0.22
6.00	0.41	0.00	0.00	16.80	5.16	1.06	0.21
6.20	0.43	0.00	0.00	17.00	5.18	1.07	0.20
6.40	0.45	0.00	0.00	17.20	5.21	1.09	0.20
6.60	0.47	0.00	0.00	17.40	5.23	1.10	0.19
6.80	0.49	0.00	0.00	17.60	5.25	1.11	0.18
7.00	0.52	0.00	0.00	17.80	5.27	1.12	0.17
7.20	0.54	0.00	0.00	18.00	5.29	1.13	0.16
7.40	0.57	0.00	0.00	18.20	5.31	1.14	0.15
7.60	0.59	0.00	0.00	18.40	5.33	1.15	0.15
7.80	0.62	0.00	0.00	18.60	5.34	1.16	0.15
8.00	0.65	0.00	0.00	18.80	5.36	1.16	0.15
8.20	0.68	0.00	0.00	19.00	5.38	1.17	0.14
8.40	0.71	0.00	0.00	19.20	5.39	1.18	0.14
8.60	0.75	0.00	0.00	19.40	5.41	1.19	0.14
8.80	0.79	0.00	0.00	19.60	5.42	1.20	0.14
9.00	0.83	0.00	0.00	19.80	5.44	1.21	0.13
9.20	0.87	0.00	0.00	20.00	5.45	1.22	0.13
9.40	0.92	0.00	0.00				
9.60	0.97	0.00	0.00				
9.80	1.02	0.00	0.00				
10.00	1.08	0.00	0.00				
10.20	1.14	0.00	0.00				
10.40	1.20	0.00	0.00				
10.60	1.27	0.00	0.00				
10.80	1.34	0.00	0.00				
11.00	1.43	0.00	0.00				
11.20	1.52	0.00	0.00				
11.40	1.63	0.00	0.00				
11.60	1.79	0.00	0.05				

15-192 Tribuna HydroCAD DA1

Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Prepared by down cape engineering, inc.

Page 6

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

7/31/2015

Pond 1P: Bioretention Infiltration Model with overflow

Grass lined bioinfiltration area with overflow infiltration

Inflow Area = 3.226 ac, Inflow Depth > 1.21" for Barn Cty 25 yr. event
 Inflow = 4.42 cfs @ 12.10 hrs, Volume= 0.326 af
 Outflow = 1.58 cfs @ 12.47 hrs, Volume= 0.320 af, Atten= 64%, Lag= 22.3 min
 Primary = 1.58 cfs @ 12.47 hrs, Volume= 0.320 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.02 hrs
 Peak Elev= 92.85' @ 12.47 hrs Surf.Area= 0 sf Storage= 2,866 cf

Plug-Flow detention time=19.9 min calculated for 0.320 af (98% of inflow)
 Center-of-Mass det. time=13.5 min (845.7 - 832.2)

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	4,000 cf	Infiltration System Storage Model Listed below

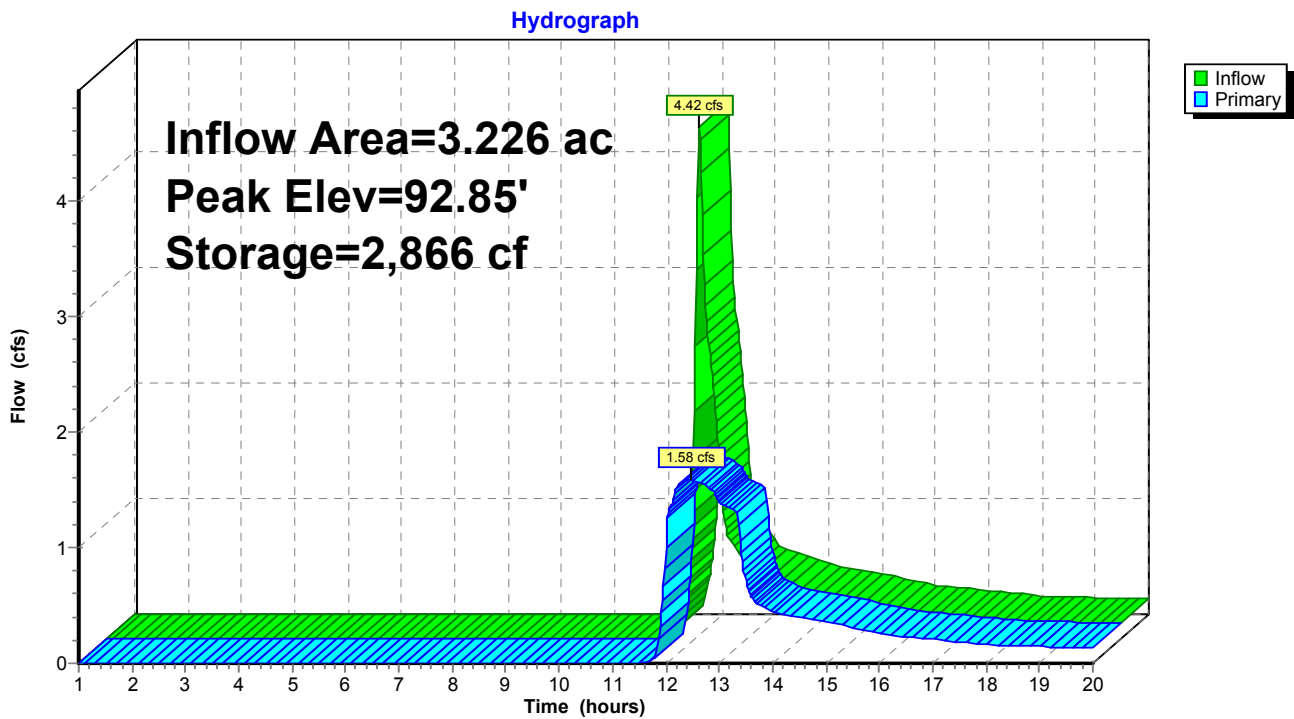
Elevation (feet)	Cum.Store (cubic-feet)
89.00	0
89.20	100
90.00	220
91.00	1,609
92.00	2,002
93.00	3,019
94.00	4,000

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	Infiltration Model
Elev. (feet) 89.00 89.20 90.00 90.30 92.00 93.00 94.00			
Disch. (cfs) 0.000 0.030 0.030 1.300 1.500 1.600 1.700			

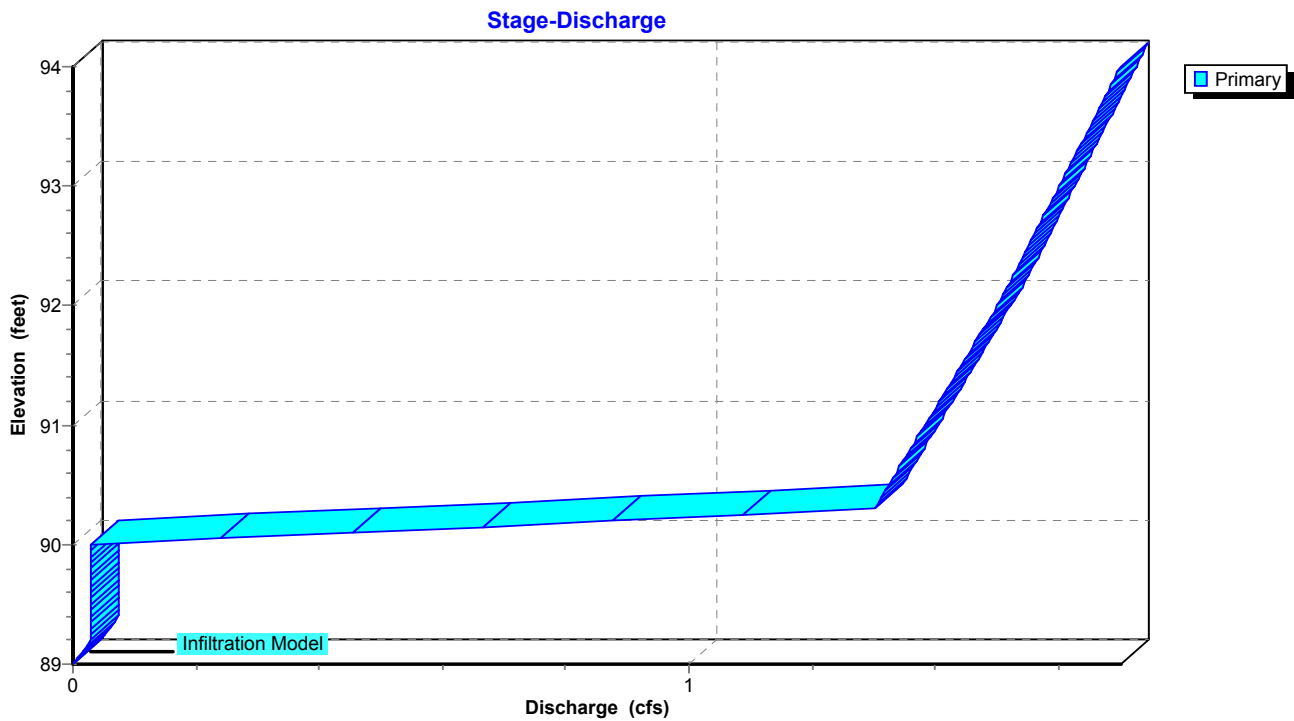
Primary OutFlow Max=1.58 cfs @ 12.47 hrs HW=92.85' (Free Discharge)

↑1=**Infiltration Model** (Custom Controls 1.58 cfs)

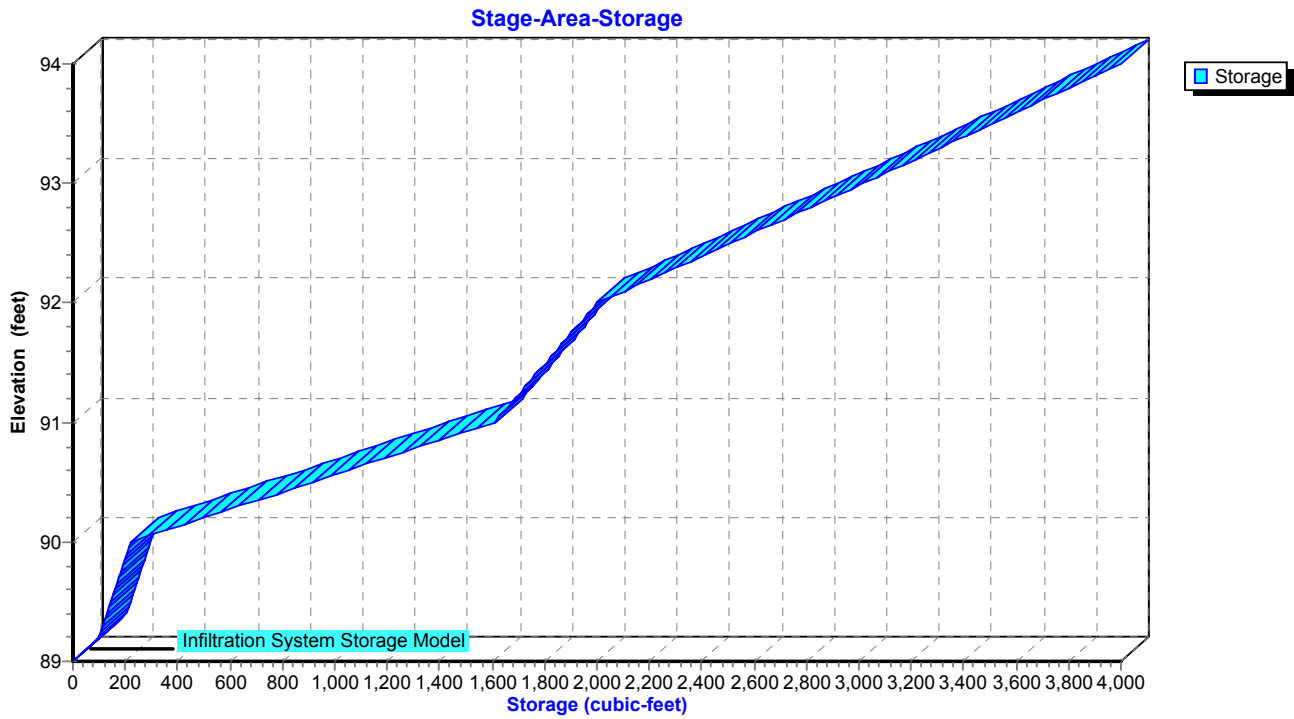
Pond 1P: Bioretention Infiltration Model with overflow



Pond 1P: Bioretention Infiltration Model with overflow



Pond 1P: Bioretention Infiltration Model with overflow



15-192 Tribuna HydroCAD DA1

Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Prepared by down cape engineering, inc.

Page 9

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

7/31/2015

Hydrograph for Pond 1P: Bioretention Infiltration Model with overflow

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
1.00	0.00	0	89.00	0.00	11.80	0.42	133	89.42	0.03
1.20	0.00	0	89.00	0.00	12.00	1.97	539	90.23	1.00
1.40	0.00	0	89.00	0.00	12.20	3.06	2,156	92.15	1.52
1.60	0.00	0	89.00	0.00	12.40	1.98	2,812	92.80	1.58
1.80	0.00	0	89.00	0.00	12.60	0.95	2,711	92.70	1.57
2.00	0.00	0	89.00	0.00	12.80	0.76	2,201	92.20	1.52
2.20	0.00	0	89.00	0.00	13.00	0.64	1,649	91.10	1.39
2.40	0.00	0	89.00	0.00	13.20	0.57	1,095	90.63	1.34
2.60	0.00	0	89.00	0.00	13.40	0.54	560	90.24	1.07
2.80	0.00	0	89.00	0.00	13.60	0.51	399	90.13	0.58
3.00	0.00	0	89.00	0.00	13.80	0.47	372	90.11	0.49
3.20	0.00	0	89.00	0.00	14.00	0.44	359	90.10	0.45
3.40	0.00	0	89.00	0.00	14.20	0.41	349	90.09	0.42
3.60	0.00	0	89.00	0.00	14.40	0.40	343	90.09	0.40
3.80	0.00	0	89.00	0.00	14.60	0.38	338	90.08	0.39
4.00	0.00	0	89.00	0.00	14.80	0.36	332	90.08	0.37
4.20	0.00	0	89.00	0.00	15.00	0.35	326	90.08	0.35
4.40	0.00	0	89.00	0.00	15.20	0.33	321	90.07	0.34
4.60	0.00	0	89.00	0.00	15.40	0.31	315	90.07	0.32
4.80	0.00	0	89.00	0.00	15.60	0.29	308	90.06	0.30
5.00	0.00	0	89.00	0.00	15.80	0.27	302	90.06	0.28
5.20	0.00	0	89.00	0.00	16.00	0.25	296	90.05	0.26
5.40	0.00	0	89.00	0.00	16.20	0.24	290	90.05	0.24
5.60	0.00	0	89.00	0.00	16.40	0.23	287	90.05	0.23
5.80	0.00	0	89.00	0.00	16.60	0.22	284	90.05	0.22
6.00	0.00	0	89.00	0.00	16.80	0.21	281	90.04	0.22
6.20	0.00	0	89.00	0.00	17.00	0.20	278	90.04	0.21
6.40	0.00	0	89.00	0.00	17.20	0.20	276	90.04	0.20
6.60	0.00	0	89.00	0.00	17.40	0.19	273	90.04	0.19
6.80	0.00	0	89.00	0.00	17.60	0.18	270	90.04	0.18
7.00	0.00	0	89.00	0.00	17.80	0.17	267	90.03	0.17
7.20	0.00	0	89.00	0.00	18.00	0.16	264	90.03	0.16
7.40	0.00	0	89.00	0.00	18.20	0.15	261	90.03	0.16
7.60	0.00	0	89.00	0.00	18.40	0.15	260	90.03	0.15
7.80	0.00	0	89.00	0.00	18.60	0.15	259	90.03	0.15
8.00	0.00	0	89.00	0.00	18.80	0.15	258	90.03	0.15
8.20	0.00	0	89.00	0.00	19.00	0.14	258	90.03	0.14
8.40	0.00	0	89.00	0.00	19.20	0.14	257	90.03	0.14
8.60	0.00	0	89.00	0.00	19.40	0.14	256	90.03	0.14
8.80	0.00	0	89.00	0.00	19.60	0.14	255	90.03	0.14
9.00	0.00	0	89.00	0.00	19.80	0.13	254	90.02	0.13
9.20	0.00	0	89.00	0.00	20.00	0.13	253	90.02	0.13
9.40	0.00	0	89.00	0.00					
9.60	0.00	0	89.00	0.00					
9.80	0.00	0	89.00	0.00					
10.00	0.00	0	89.00	0.00					
10.20	0.00	0	89.00	0.00					
10.40	0.00	0	89.00	0.00					
10.60	0.00	0	89.00	0.00					
10.80	0.00	0	89.00	0.00					
11.00	0.00	0	89.00	0.00					
11.20	0.00	0	89.00	0.00					
11.40	0.00	0	89.00	0.00					
11.60	0.05	8	89.02	0.00					

15-192 Tribuna HydroCAD DA1

Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Prepared by down cape engineering, inc.

Page 10

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

7/31/2015

Stage-Discharge for Pond 1P: Bioretention Infiltration Model with overflow

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
89.00	0.00	90.08	0.37	91.16	1.40	92.24	1.52	93.32	1.63
89.02	0.00	90.10	0.45	91.18	1.40	92.26	1.53	93.34	1.63
89.04	0.01	90.12	0.54	91.20	1.41	92.28	1.53	93.36	1.64
89.06	0.01	90.14	0.62	91.22	1.41	92.30	1.53	93.38	1.64
89.08	0.01	90.16	0.71	91.24	1.41	92.32	1.53	93.40	1.64
89.10	0.01	90.18	0.79	91.26	1.41	92.34	1.53	93.42	1.64
89.12	0.02	90.20	0.88	91.28	1.42	92.36	1.54	93.44	1.64
89.14	0.02	90.22	0.96	91.30	1.42	92.38	1.54	93.46	1.65
89.16	0.02	90.24	1.05	91.32	1.42	92.40	1.54	93.48	1.65
89.18	0.03	90.26	1.13	91.34	1.42	92.42	1.54	93.50	1.65
89.20	0.03	90.28	1.22	91.36	1.42	92.44	1.54	93.52	1.65
89.22	0.03	90.30	1.30	91.38	1.43	92.46	1.55	93.54	1.65
89.24	0.03	90.32	1.30	91.40	1.43	92.48	1.55	93.56	1.66
89.26	0.03	90.34	1.30	91.42	1.43	92.50	1.55	93.58	1.66
89.28	0.03	90.36	1.31	91.44	1.43	92.52	1.55	93.60	1.66
89.30	0.03	90.38	1.31	91.46	1.44	92.54	1.55	93.62	1.66
89.32	0.03	90.40	1.31	91.48	1.44	92.56	1.56	93.64	1.66
89.34	0.03	90.42	1.31	91.50	1.44	92.58	1.56	93.66	1.67
89.36	0.03	90.44	1.32	91.52	1.44	92.60	1.56	93.68	1.67
89.38	0.03	90.46	1.32	91.54	1.45	92.62	1.56	93.70	1.67
89.40	0.03	90.48	1.32	91.56	1.45	92.64	1.56	93.72	1.67
89.42	0.03	90.50	1.32	91.58	1.45	92.66	1.57	93.74	1.67
89.44	0.03	90.52	1.33	91.60	1.45	92.68	1.57	93.76	1.68
89.46	0.03	90.54	1.33	91.62	1.46	92.70	1.57	93.78	1.68
89.48	0.03	90.56	1.33	91.64	1.46	92.72	1.57	93.80	1.68
89.50	0.03	90.58	1.33	91.66	1.46	92.74	1.57	93.82	1.68
89.52	0.03	90.60	1.34	91.68	1.46	92.76	1.58	93.84	1.68
89.54	0.03	90.62	1.34	91.70	1.46	92.78	1.58	93.86	1.69
89.56	0.03	90.64	1.34	91.72	1.47	92.80	1.58	93.88	1.69
89.58	0.03	90.66	1.34	91.74	1.47	92.82	1.58	93.90	1.69
89.60	0.03	90.68	1.34	91.76	1.47	92.84	1.58	93.92	1.69
89.62	0.03	90.70	1.35	91.78	1.47	92.86	1.59	93.94	1.69
89.64	0.03	90.72	1.35	91.80	1.48	92.88	1.59	93.96	1.70
89.66	0.03	90.74	1.35	91.82	1.48	92.90	1.59	93.98	1.70
89.68	0.03	90.76	1.35	91.84	1.48	92.92	1.59	94.00	1.70
89.70	0.03	90.78	1.36	91.86	1.48	92.94	1.59		
89.72	0.03	90.80	1.36	91.88	1.49	92.96	1.60		
89.74	0.03	90.82	1.36	91.90	1.49	92.98	1.60		
89.76	0.03	90.84	1.36	91.92	1.49	93.00	1.60		
89.78	0.03	90.86	1.37	91.94	1.49	93.02	1.60		
89.80	0.03	90.88	1.37	91.96	1.50	93.04	1.60		
89.82	0.03	90.90	1.37	91.98	1.50	93.06	1.61		
89.84	0.03	90.92	1.37	92.00	1.50	93.08	1.61		
89.86	0.03	90.94	1.38	92.02	1.50	93.10	1.61		
89.88	0.03	90.96	1.38	92.04	1.50	93.12	1.61		
89.90	0.03	90.98	1.38	92.06	1.51	93.14	1.61		
89.92	0.03	91.00	1.38	92.08	1.51	93.16	1.62		
89.94	0.03	91.02	1.38	92.10	1.51	93.18	1.62		
89.96	0.03	91.04	1.39	92.12	1.51	93.20	1.62		
89.98	0.03	91.06	1.39	92.14	1.51	93.22	1.62		
90.00	0.03	91.08	1.39	92.16	1.52	93.24	1.62		
90.02	0.11	91.10	1.39	92.18	1.52	93.26	1.63		
90.04	0.20	91.12	1.40	92.20	1.52	93.28	1.63		
90.06	0.28	91.14	1.40	92.22	1.52	93.30	1.63		

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

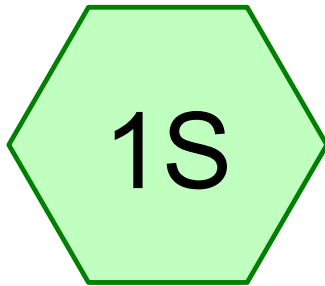
Type III 24-hr Barn Cty 25 yr. Rainfall=5.70"

Page 11

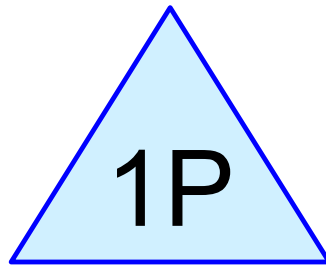
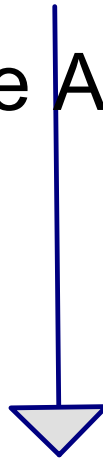
7/31/2015

Stage-Area-Storage for Pond 1P: Bioretention Infiltration Model with overflow

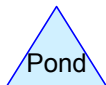
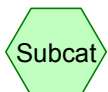
Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
89.00	0	91.70	1,884
89.05	25	91.75	1,904
89.10	50	91.80	1,923
89.15	75	91.85	1,943
89.20	100	91.90	1,963
89.25	107	91.95	1,982
89.30	115	92.00	2,002
89.35	122	92.05	2,053
89.40	130	92.10	2,104
89.45	138	92.15	2,155
89.50	145	92.20	2,205
89.55	152	92.25	2,256
89.60	160	92.30	2,307
89.65	168	92.35	2,358
89.70	175	92.40	2,409
89.75	182	92.45	2,460
89.80	190	92.50	2,511
89.85	197	92.55	2,561
89.90	205	92.60	2,612
89.95	213	92.65	2,663
90.00	220	92.70	2,714
90.05	289	92.75	2,765
90.10	359	92.80	2,816
90.15	428	92.85	2,866
90.20	498	92.90	2,917
90.25	567	92.95	2,968
90.30	637	93.00	3,019
90.35	706	93.05	3,068
90.40	776	93.10	3,117
90.45	845	93.15	3,166
90.50	915	93.20	3,215
90.55	984	93.25	3,264
90.60	1,053	93.30	3,313
90.65	1,123	93.35	3,362
90.70	1,192	93.40	3,411
90.75	1,262	93.45	3,460
90.80	1,331	93.50	3,510
90.85	1,401	93.55	3,559
90.90	1,470	93.60	3,608
90.95	1,540	93.65	3,657
91.00	1,609	93.70	3,706
91.05	1,629	93.75	3,755
91.10	1,648	93.80	3,804
91.15	1,668	93.85	3,853
91.20	1,688	93.90	3,902
91.25	1,707	93.95	3,951
91.30	1,727	94.00	4,000
91.35	1,747		
91.40	1,766		
91.45	1,786		
91.50	1,806		
91.55	1,825		
91.60	1,845		
91.65	1,864		



Drainage Area DA1



Bioretention Infiltration
Model with overflow



Drainage Diagram for 15-192 Tribuna HydroCAD DA1
Prepared by down cape engineering, inc. 8/1/2015
HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Page 2

8/1/2015

Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
0.582	30	Woods, Good, HSG A (1S)
2.589	60	Gravel drives, driveways, parking (1S)
0.055	98	Buildings (1S)
<hr/>		
3.226		

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

50 Year 24 Hour Rainfall USDA NRCS

Type III 24-hr Rainfall=6.30"

Page 3

8/1/2015

Time span=1.00-20.00 hrs, dt=0.02 hrs, 951 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Drainage Area DA1

Runoff Area=140,546 sf Runoff Depth>1.53"

Tc=10.0 min CN=55 Runoff=5.02 cfs 0.411 af

Pond 1P: Bioretention Infiltration Model with overflow

Peak Elev=93.88' Storage=3,887 cf Inflow=5.02 cfs 0.411 af

Outflow=1.89 cfs 0.405 af

Total Runoff Area = 3.226 ac Runoff Volume = 0.411 af Average Runoff Depth = 1.53"

98.29% Pervious Area = 3.171 ac 1.71% Impervious Area = 0.055 ac

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.
 HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Subcatchment 1S: Drainage Area DA1

Time of Concentration

Runoff = 5.02 cfs @ 12.15 hrs, Volume= 0.411 af, Depth> 1.53"

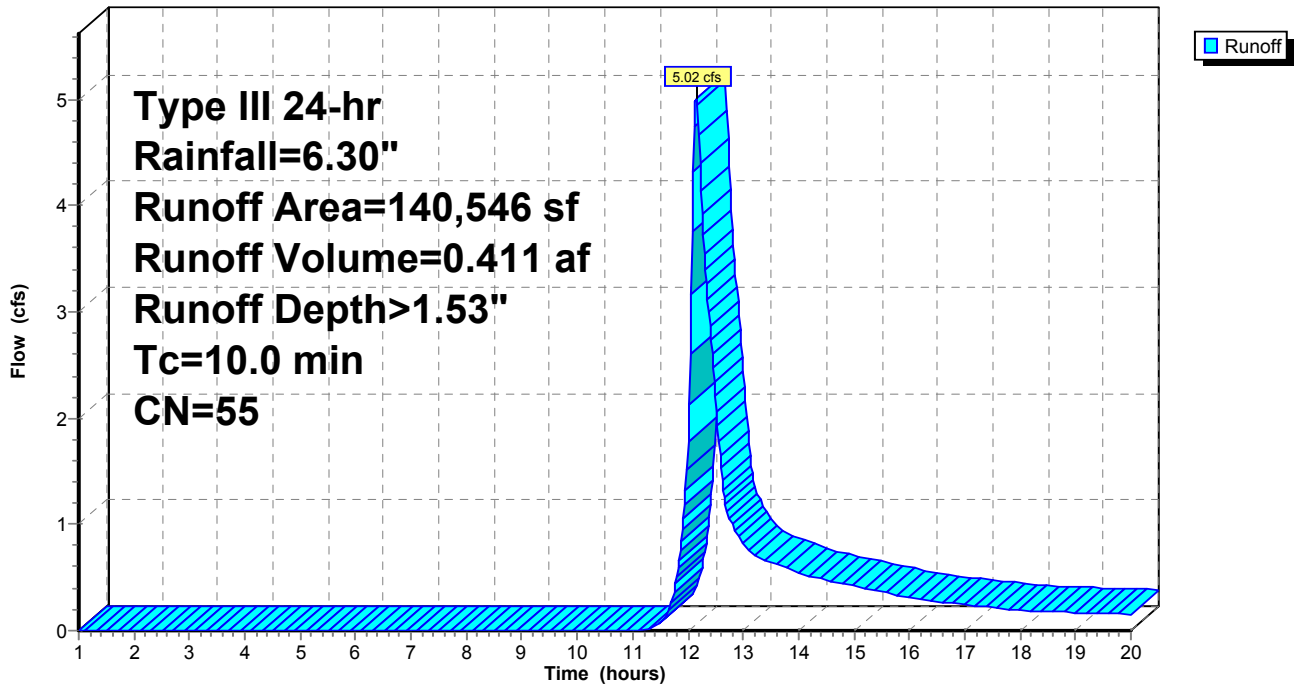
Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-20.00 hrs, dt= 0.02 hrs
 Type III 24-hr Rainfall=6.30"

Area (sf)	CN	Description
2,400	98	Buildings
25,371	30	Woods, Good, HSG A
112,775	60	Gravel drives, driveways, parking
140,546	55	Weighted Average
138,146		Pervious Area
2,400		Impervious Area

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

Subcatchment 1S: Drainage Area DA1

Hydrograph



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Page 5

8/1/2015

Hydrograph for Subcatchment 1S: Drainage Area DA1

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
1.00	0.06	0.00	0.00	11.60	1.98	0.01	0.12
1.20	0.08	0.00	0.00	11.80	2.35	0.06	0.51
1.40	0.09	0.00	0.00	12.00	3.15	0.24	1.77
1.60	0.10	0.00	0.00	12.20	3.95	0.51	4.66
1.80	0.11	0.00	0.00	12.40	4.32	0.66	2.86
2.00	0.13	0.00	0.00	12.60	4.49	0.74	1.52
2.20	0.14	0.00	0.00	12.80	4.62	0.80	1.00
2.40	0.15	0.00	0.00	13.00	4.72	0.85	0.83
2.60	0.17	0.00	0.00	13.20	4.81	0.89	0.71
2.80	0.18	0.00	0.00	13.40	4.90	0.93	0.66
3.00	0.19	0.00	0.00	13.60	4.97	0.97	0.63
3.20	0.21	0.00	0.00	13.80	5.04	1.00	0.59
3.40	0.22	0.00	0.00	14.00	5.11	1.03	0.54
3.60	0.24	0.00	0.00	14.20	5.17	1.07	0.51
3.80	0.25	0.00	0.00	14.40	5.23	1.10	0.49
4.00	0.27	0.00	0.00	14.60	5.28	1.12	0.47
4.20	0.29	0.00	0.00	14.80	5.33	1.15	0.45
4.40	0.30	0.00	0.00	15.00	5.38	1.18	0.42
4.60	0.32	0.00	0.00	15.20	5.43	1.20	0.40
4.80	0.34	0.00	0.00	15.40	5.47	1.22	0.38
5.00	0.36	0.00	0.00	15.60	5.51	1.24	0.36
5.20	0.38	0.00	0.00	15.80	5.55	1.26	0.33
5.40	0.39	0.00	0.00	16.00	5.58	1.28	0.31
5.60	0.41	0.00	0.00	16.20	5.61	1.30	0.29
5.80	0.43	0.00	0.00	16.40	5.64	1.32	0.28
6.00	0.45	0.00	0.00	16.60	5.67	1.33	0.27
6.20	0.47	0.00	0.00	16.80	5.70	1.35	0.26
6.40	0.50	0.00	0.00	17.00	5.73	1.37	0.25
6.60	0.52	0.00	0.00	17.20	5.76	1.38	0.24
6.80	0.54	0.00	0.00	17.40	5.78	1.39	0.23
7.00	0.57	0.00	0.00	17.60	5.80	1.41	0.22
7.20	0.60	0.00	0.00	17.80	5.83	1.42	0.20
7.40	0.63	0.00	0.00	18.00	5.85	1.43	0.19
7.60	0.66	0.00	0.00	18.20	5.87	1.44	0.18
7.80	0.69	0.00	0.00	18.40	5.89	1.45	0.18
8.00	0.72	0.00	0.00	18.60	5.91	1.46	0.18
8.20	0.75	0.00	0.00	18.80	5.92	1.47	0.18
8.40	0.79	0.00	0.00	19.00	5.94	1.48	0.17
8.60	0.83	0.00	0.00	19.20	5.96	1.50	0.17
8.80	0.87	0.00	0.00	19.40	5.98	1.51	0.17
9.00	0.92	0.00	0.00	19.60	6.00	1.52	0.16
9.20	0.97	0.00	0.00	19.80	6.01	1.52	0.16
9.40	1.02	0.00	0.00	20.00	6.03	1.53	0.16
9.60	1.07	0.00	0.00				
9.80	1.13	0.00	0.00				
10.00	1.19	0.00	0.00				
10.20	1.26	0.00	0.00				
10.40	1.33	0.00	0.00				
10.60	1.40	0.00	0.00				
10.80	1.49	0.00	0.00				
11.00	1.58	0.00	0.00				
11.20	1.68	0.00	0.00				
11.40	1.81	0.00	0.04				

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Pond 1P: Bioretention Infiltration Model with overflow

Grass lined bioinfiltration area with overflow infiltration

Inflow Area = 3.226 ac, Inflow Depth > 1.53"
 Inflow = 5.02 cfs @ 12.15 hrs, Volume= 0.411 af
 Outflow = 1.89 cfs @ 12.55 hrs, Volume= 0.405 af, Atten= 62%, Lag= 23.4 min
 Primary = 1.89 cfs @ 12.55 hrs, Volume= 0.405 af

Routing by Stor-Ind method, Time Span= 1.00-20.00 hrs, dt= 0.02 hrs
 Peak Elev= 93.88' @ 12.55 hrs Surf.Area= 0 sf Storage= 3,887 cf

Plug-Flow detention time=20.7 min calculated for 0.404 af (98% of inflow)
 Center-of-Mass det. time=15.4 min (845.0 - 829.5)

Volume	Invert	Avail.Storage	Storage Description
#1	89.00'	4,000 cf	Infiltration System Storage Model Listed below

Elevation (feet)	Cum.Store (cubic-feet)
89.00	0
89.20	100
90.00	220
91.00	1,609
92.00	2,002
93.00	3,019
94.00	4,000

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	Infiltration Model
Elev. (feet) 89.00 89.20 90.00 90.30 92.00 93.00 94.00			
Disch. (cfs) 0.000 0.030 0.030 1.400 1.600 1.800 1.900			

Primary OutFlow Max=1.89 cfs @ 12.55 hrs HW=93.88' (Free Discharge)

↑1=**Infiltration Model** (Custom Controls 1.89 cfs)

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

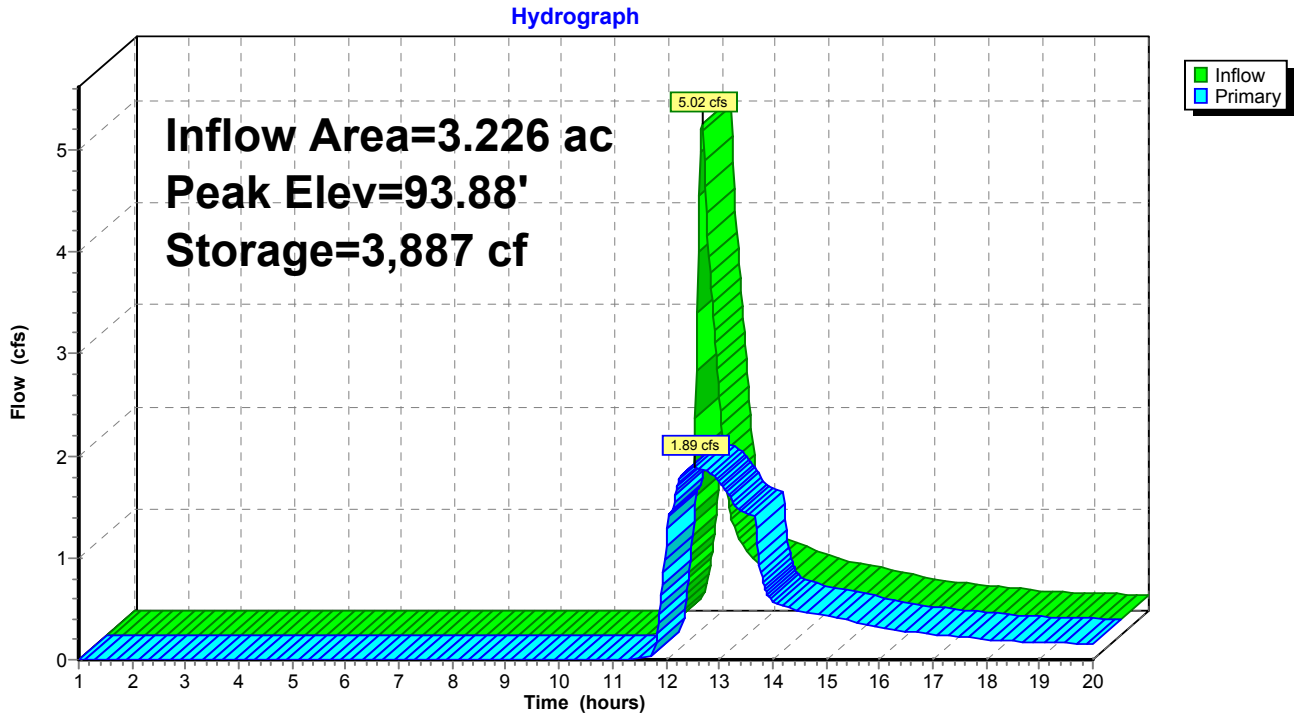
50 Year 24 Hour Rainfall USDA NRCS

Type III 24-hr Rainfall=6.30"

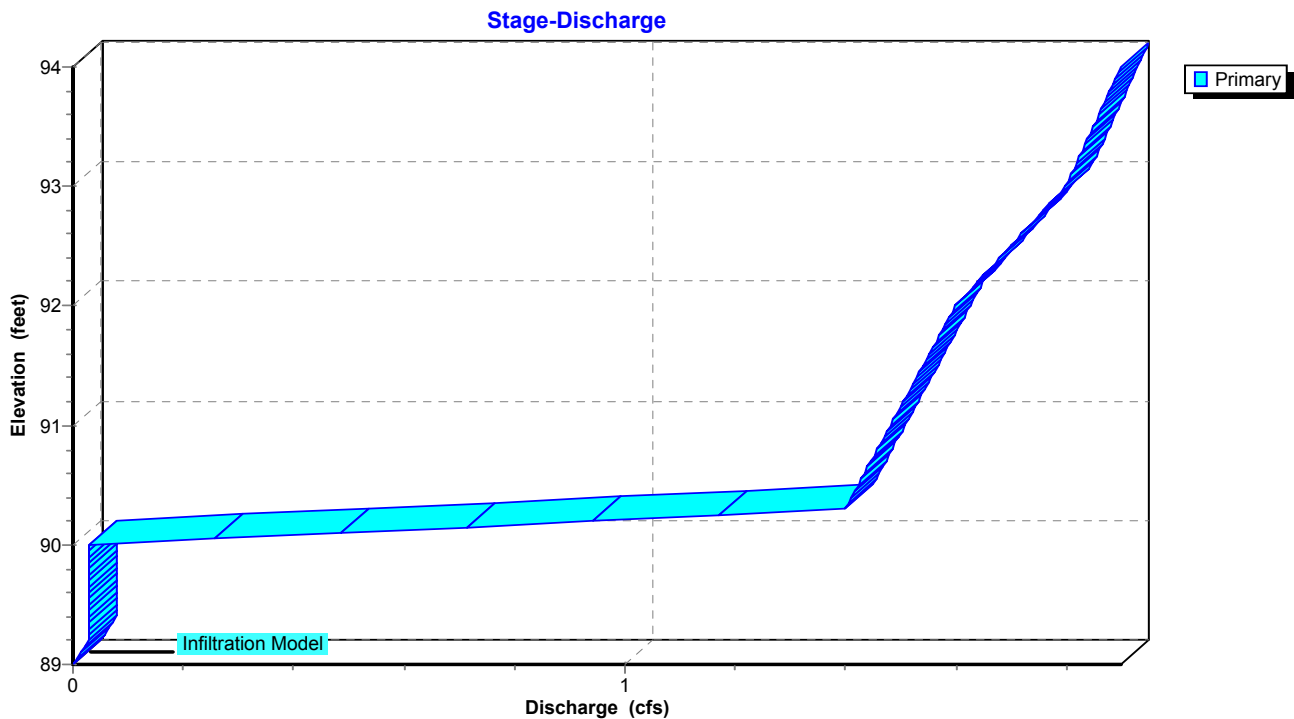
Page 7

8/1/2015

Pond 1P: Bioretention Infiltration Model with overflow



Pond 1P: Bioretention Infiltration Model with overflow



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

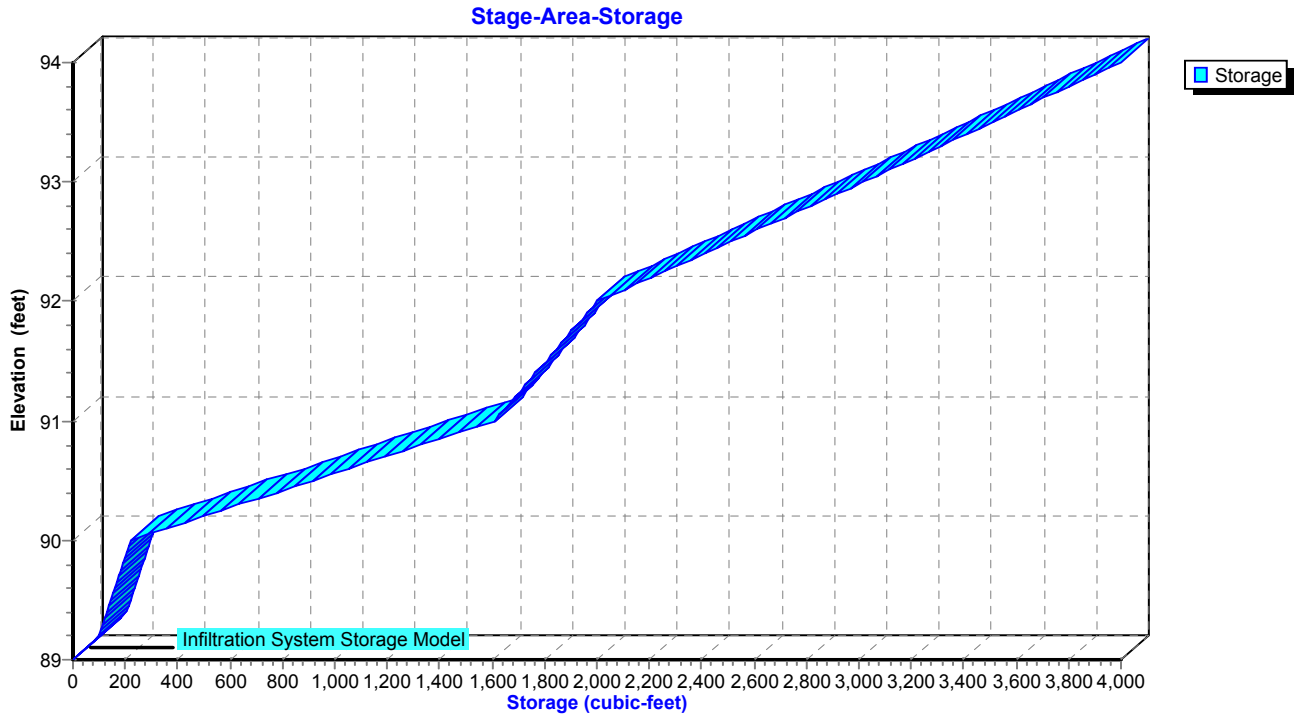
50 Year 24 Hour Rainfall USDA NRCS

Type III 24-hr Rainfall=6.30"

Page 8

8/1/2015

Pond 1P: Bioretention Infiltration Model with overflow



15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Page 9

8/1/2015

Hydrograph for Pond 1P: Bioretention Infiltration Model with overflow

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)	Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
1.00	0.00	0	89.00	0.00	11.60	0.12	55	89.11	0.02
1.20	0.00	0	89.00	0.00	11.80	0.51	230	90.01	0.06
1.40	0.00	0	89.00	0.00	12.00	1.77	550	90.24	1.11
1.60	0.00	0	89.00	0.00	12.20	4.66	2,302	92.30	1.66
1.80	0.00	0	89.00	0.00	12.40	2.86	3,622	93.61	1.86
2.00	0.00	0	89.00	0.00	12.60	1.52	3,850	93.85	1.88
2.20	0.00	0	89.00	0.00	12.80	1.00	3,363	93.35	1.84
2.40	0.00	0	89.00	0.00	13.00	0.83	2,726	92.71	1.74
2.60	0.00	0	89.00	0.00	13.20	0.71	2,067	92.06	1.61
2.80	0.00	0	89.00	0.00	13.40	0.66	1,458	90.89	1.47
3.00	0.00	0	89.00	0.00	13.60	0.63	882	90.48	1.42
3.20	0.00	0	89.00	0.00	13.80	0.59	455	90.17	0.80
3.40	0.00	0	89.00	0.00	14.00	0.54	387	90.12	0.58
3.60	0.00	0	89.00	0.00	14.20	0.51	370	90.11	0.52
3.80	0.00	0	89.00	0.00	14.40	0.49	361	90.10	0.50
4.00	0.00	0	89.00	0.00	14.60	0.47	355	90.10	0.47
4.20	0.00	0	89.00	0.00	14.80	0.45	349	90.09	0.45
4.40	0.00	0	89.00	0.00	15.00	0.42	343	90.09	0.43
4.60	0.00	0	89.00	0.00	15.20	0.40	336	90.08	0.41
4.80	0.00	0	89.00	0.00	15.40	0.38	329	90.08	0.39
5.00	0.00	0	89.00	0.00	15.60	0.36	322	90.07	0.37
5.20	0.00	0	89.00	0.00	15.80	0.33	315	90.07	0.34
5.40	0.00	0	89.00	0.00	16.00	0.31	308	90.06	0.32
5.60	0.00	0	89.00	0.00	16.20	0.29	301	90.06	0.30
5.80	0.00	0	89.00	0.00	16.40	0.28	297	90.06	0.28
6.00	0.00	0	89.00	0.00	16.60	0.27	294	90.05	0.27
6.20	0.00	0	89.00	0.00	16.80	0.26	291	90.05	0.26
6.40	0.00	0	89.00	0.00	17.00	0.25	287	90.05	0.25
6.60	0.00	0	89.00	0.00	17.20	0.24	284	90.05	0.24
6.80	0.00	0	89.00	0.00	17.40	0.23	281	90.04	0.23
7.00	0.00	0	89.00	0.00	17.60	0.22	278	90.04	0.22
7.20	0.00	0	89.00	0.00	17.80	0.20	274	90.04	0.21
7.40	0.00	0	89.00	0.00	18.00	0.19	271	90.04	0.20
7.60	0.00	0	89.00	0.00	18.20	0.18	268	90.03	0.19
7.80	0.00	0	89.00	0.00	18.40	0.18	266	90.03	0.18
8.00	0.00	0	89.00	0.00	18.60	0.18	265	90.03	0.18
8.20	0.00	0	89.00	0.00	18.80	0.18	265	90.03	0.18
8.40	0.00	0	89.00	0.00	19.00	0.17	264	90.03	0.17
8.60	0.00	0	89.00	0.00	19.20	0.17	263	90.03	0.17
8.80	0.00	0	89.00	0.00	19.40	0.17	262	90.03	0.17
9.00	0.00	0	89.00	0.00	19.60	0.16	261	90.03	0.16
9.20	0.00	0	89.00	0.00	19.80	0.16	260	90.03	0.16
9.40	0.00	0	89.00	0.00	20.00	0.16	259	90.03	0.16
9.60	0.00	0	89.00	0.00					
9.80	0.00	0	89.00	0.00					
10.00	0.00	0	89.00	0.00					
10.20	0.00	0	89.00	0.00					
10.40	0.00	0	89.00	0.00					
10.60	0.00	0	89.00	0.00					
10.80	0.00	0	89.00	0.00					
11.00	0.00	0	89.00	0.00					
11.20	0.00	0	89.00	0.00					
11.40	0.04	9	89.02	0.00					

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Stage-Discharge for Pond 1P: Bioretention Infiltration Model with overflow

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
89.00	0.00	90.06	0.30	91.12	1.50	92.18	1.64	93.24	1.82
89.02	0.00	90.08	0.40	91.14	1.50	92.20	1.64	93.26	1.83
89.04	0.01	90.10	0.49	91.16	1.50	92.22	1.64	93.28	1.83
89.06	0.01	90.12	0.58	91.18	1.50	92.24	1.65	93.30	1.83
89.08	0.01	90.14	0.67	91.20	1.51	92.26	1.65	93.32	1.83
89.10	0.01	90.16	0.76	91.22	1.51	92.28	1.66	93.34	1.83
89.12	0.02	90.18	0.85	91.24	1.51	92.30	1.66	93.36	1.84
89.14	0.02	90.20	0.94	91.26	1.51	92.32	1.66	93.38	1.84
89.16	0.02	90.22	1.03	91.28	1.52	92.34	1.67	93.40	1.84
89.18	0.03	90.24	1.13	91.30	1.52	92.36	1.67	93.42	1.84
89.20	0.03	90.26	1.22	91.32	1.52	92.38	1.68	93.44	1.84
89.22	0.03	90.28	1.31	91.34	1.52	92.40	1.68	93.46	1.85
89.24	0.03	90.30	1.40	91.36	1.52	92.42	1.68	93.48	1.85
89.26	0.03	90.32	1.40	91.38	1.53	92.44	1.69	93.50	1.85
89.28	0.03	90.34	1.40	91.40	1.53	92.46	1.69	93.52	1.85
89.30	0.03	90.36	1.41	91.42	1.53	92.48	1.70	93.54	1.85
89.32	0.03	90.38	1.41	91.44	1.53	92.50	1.70	93.56	1.86
89.34	0.03	90.40	1.41	91.46	1.54	92.52	1.70	93.58	1.86
89.36	0.03	90.42	1.41	91.48	1.54	92.54	1.71	93.60	1.86
89.38	0.03	90.44	1.42	91.50	1.54	92.56	1.71	93.62	1.86
89.40	0.03	90.46	1.42	91.52	1.54	92.58	1.72	93.64	1.86
89.42	0.03	90.48	1.42	91.54	1.55	92.60	1.72	93.66	1.87
89.44	0.03	90.50	1.42	91.56	1.55	92.62	1.72	93.68	1.87
89.46	0.03	90.52	1.43	91.58	1.55	92.64	1.73	93.70	1.87
89.48	0.03	90.54	1.43	91.60	1.55	92.66	1.73	93.72	1.87
89.50	0.03	90.56	1.43	91.62	1.56	92.68	1.74	93.74	1.87
89.52	0.03	90.58	1.43	91.64	1.56	92.70	1.74	93.76	1.88
89.54	0.03	90.60	1.44	91.66	1.56	92.72	1.74	93.78	1.88
89.56	0.03	90.62	1.44	91.68	1.56	92.74	1.75	93.80	1.88
89.58	0.03	90.64	1.44	91.70	1.56	92.76	1.75	93.82	1.88
89.60	0.03	90.66	1.44	91.72	1.57	92.78	1.76	93.84	1.88
89.62	0.03	90.68	1.44	91.74	1.57	92.80	1.76	93.86	1.89
89.64	0.03	90.70	1.45	91.76	1.57	92.82	1.76	93.88	1.89
89.66	0.03	90.72	1.45	91.78	1.57	92.84	1.77	93.90	1.89
89.68	0.03	90.74	1.45	91.80	1.58	92.86	1.77	93.92	1.89
89.70	0.03	90.76	1.45	91.82	1.58	92.88	1.78	93.94	1.89
89.72	0.03	90.78	1.46	91.84	1.58	92.90	1.78	93.96	1.90
89.74	0.03	90.80	1.46	91.86	1.58	92.92	1.78	93.98	1.90
89.76	0.03	90.82	1.46	91.88	1.59	92.94	1.79	94.00	1.90
89.78	0.03	90.84	1.46	91.90	1.59	92.96	1.79		
89.80	0.03	90.86	1.47	91.92	1.59	92.98	1.80		
89.82	0.03	90.88	1.47	91.94	1.59	93.00	1.80		
89.84	0.03	90.90	1.47	91.96	1.60	93.02	1.80		
89.86	0.03	90.92	1.47	91.98	1.60	93.04	1.80		
89.88	0.03	90.94	1.48	92.00	1.60	93.06	1.81		
89.90	0.03	90.96	1.48	92.02	1.60	93.08	1.81		
89.92	0.03	90.98	1.48	92.04	1.61	93.10	1.81		
89.94	0.03	91.00	1.48	92.06	1.61	93.12	1.81		
89.96	0.03	91.02	1.48	92.08	1.62	93.14	1.81		
89.98	0.03	91.04	1.49	92.10	1.62	93.16	1.82		
90.00	0.03	91.06	1.49	92.12	1.62	93.18	1.82		
90.02	0.12	91.08	1.49	92.14	1.63	93.20	1.82		
90.04	0.21	91.10	1.49	92.16	1.63	93.22	1.82		

15-192 Tribuna HydroCAD DA1

Prepared by down cape engineering, inc.

HydroCAD® 8.00 s/n 004007 © 2006 HydroCAD Software Solutions LLC

Stage-Area-Storage for Pond 1P: Bioretention Infiltration Model with overflow

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
89.00	0	91.65	1,864
89.05	25	91.70	1,884
89.10	50	91.75	1,904
89.15	75	91.80	1,923
89.20	100	91.85	1,943
89.25	107	91.90	1,963
89.30	115	91.95	1,982
89.35	122	92.00	2,002
89.40	130	92.05	2,053
89.45	138	92.10	2,104
89.50	145	92.15	2,155
89.55	152	92.20	2,205
89.60	160	92.25	2,256
89.65	168	92.30	2,307
89.70	175	92.35	2,358
89.75	182	92.40	2,409
89.80	190	92.45	2,460
89.85	197	92.50	2,511
89.90	205	92.55	2,561
89.95	213	92.60	2,612
90.00	220	92.65	2,663
90.05	289	92.70	2,714
90.10	359	92.75	2,765
90.15	428	92.80	2,816
90.20	498	92.85	2,866
90.25	567	92.90	2,917
90.30	637	92.95	2,968
90.35	706	93.00	3,019
90.40	776	93.05	3,068
90.45	845	93.10	3,117
90.50	915	93.15	3,166
90.55	984	93.20	3,215
90.60	1,053	93.25	3,264
90.65	1,123	93.30	3,313
90.70	1,192	93.35	3,362
90.75	1,262	93.40	3,411
90.80	1,331	93.45	3,460
90.85	1,401	93.50	3,510
90.90	1,470	93.55	3,559
90.95	1,540	93.60	3,608
91.00	1,609	93.65	3,657
91.05	1,629	93.70	3,706
91.10	1,648	93.75	3,755
91.15	1,668	93.80	3,804
91.20	1,688	93.85	3,853
91.25	1,707	93.90	3,902
91.30	1,727	93.95	3,951
91.35	1,747	94.00	4,000
91.40	1,766		
91.45	1,786		
91.50	1,806		
91.55	1,825		
91.60	1,845		